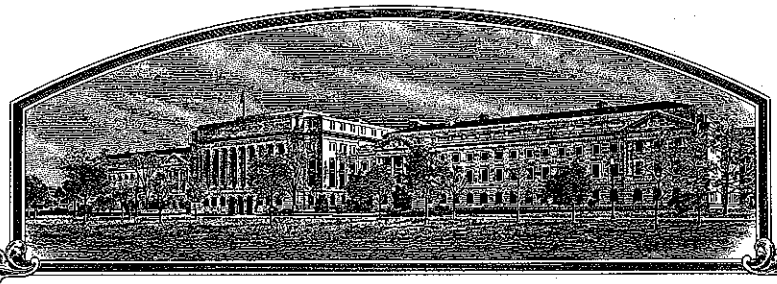
No. 200300215



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Paragon Seed, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR PORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE PURPOSE , OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

LETTUCE

'Grand Slam'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this fourteenth day of February, in the year two thousand and six.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER: Paragon Seed, Inc.

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME: Exp. 8512

3. VARIETY NAME: Grand Slam

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*: 507 Abbott Street, Salinas, California 93901

5. TELEPHONE *(include area code)*: 831-753-2100

6. FAX *(include area code)*: 831-753-1470

FOR OFFICIAL USE ONLY

PVPO NUMBER: 200300215

FILING DATE: April 16, 2003

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*: Corporation

8. IF INCORPORATED, GIVE STATE OF INCORPORATION: California

9. DATE OF INCORPORATION: March 7, 1994

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*

Victor Heintzberger
P. O. Box 1906
Salinas, California 93902-1906

FEES RECEIVED

FILING AND EXAMINATION FEES: ① 2705.00 ② 947.00

① 4/16/03 DATE ② 4/28/2003

CERTIFICATION FEE: 768 — $ Jan. 25, 2006

DATE

11. TELEPHONE *(Include area code)*: 831-753-2100

12. FAX *(Include area code)*: 831-753-1470

13. E-MAIL: lettuceseed@aol.com

14. CROP KIND *(Common Name)*: Lettuce

15. GENUS AND SPECIES NAME OF CROP: Lactuca sativa L.

16. FAMILY NAME *(Botanical)*: Compositae

17. IS THE VARIETY A FIRST GENERATION HYBRID? ☐ YES ☒ NO

18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)

- a. ☒ Exhibit A. Origin and Breeding History of the Variety
- b. ☒ Exhibit B. Statement of Distinctness
- c. ☒ Exhibit C. Objective Description of Variety
- d. ☒ Exhibit D. Additional Description of the Variety *(Optional)* (MMT 4-16-03)
- e. ☒ Exhibit E. Statement of the Basis of the Owner's Ownership
- f. ☒ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
- g. ☒ Filing and Examination Fee ($2,705), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *See Section 83(a) of the Plant Variety Protection Act)*

☐ YES *(If "yes", answer items 20 and 21 below)* ☒ NO *(If "no", go to item 22)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES? ☐ YES ☒ NO

IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS? ☐ YES ☒ NO

IF YES, SPECIFY THE NUMBER 1,2,3, *etc.* ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

(If additional explanation is necessary, please use the space indicated on the reverse.)

22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?

☒ YES ☐ NO

IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?

☒ YES ☐ NO

IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

24. The owners declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER	SIGNATURE OF OWNER
Victor Heintzberger	
NAME *(Please print or type)*: VICTOR HEINTZBERGER	NAME *(Please print or type)*
CAPACITY OR TITLE: PRESIDENT	DATE: 3/29/03
CAPACITY OR TITLE	DATE

S&T-470 (04-01) designed by the Plant Variety Protection Office with WordPerfect 6.0a. Replaces STD-470 (02-99) which is obsolete. *(See reverse for instructions and information collection burden statement)*

Paragon Seed, Inc.

Iceberg Lettuce Variety **GRAND SLAM**

Experimental Designation **EXP 8512**

23. Date of first sale : April 16, 2002

Salinas, California U.S.A.

24. Parental Lines : **Hallmark W**
Paragon Seed, Inc.
PVP # 99000222

9602
University of California, Davis
& The United States Department of
Agriculture/ARS Salinas, California

Exhibit A

Breeding History Grand Slam "Exp. 8512"

Grand Slam is the result of a hand pollinated cross made by Paragon Seed, Inc. personnel in the San Joaquin Valley of California in 1997.
The female (receptor) parent was the breeding line Px 37 ws, which became the lettuce variety Hallmark W (PVP # 9900222). Px 37ws was selected for it's excellent heading ability, uniformity of type, slow bolting, tipburn resistance and corky root resistance (cor gene). Seed color of Px 37 ws is white (silver).

The male (pollen parent) selected for this cross was the breeding line "9602".
9602 was developed and released in 1996 by Dr. Richard Michelmore and Oswaldo Ochoa of the University of California at Davis in collaboration with Dr. Edward J. Ryder at the USDA/ARS in Salinas, California. At the time of release, 9602 possessed the downy mildew resistance factor *R*32 from L. saligna LJ-81632 that conferred resistance effective against all California isolates tested to date. In Richard Michelmores report to the 1999-2000 California Lettuce Research Board, he concluded that "*Dm* 18 and *R* 32 seem to functionally identical" and "...*R* 32 does not provide a new spectrum of resistance and can be used interchangeably with *Dm* 18".

Seed color of 9602 is black.

In July, 1997, a hand pollinated cross was made between Px 37w/s and 9602. The cross was designated 3796. F1 seed was harvested in August of 1997. Seeds of the cross were germinated in petrie dishes on November 12, 1997 and transferred to five-gallon pots for the purpose of seed production. Four plants survived winter greenhouse production and seed was harvested in April, 1998. F2 seed was again germinated in petrie dishes and transferred to transplant trays at the seedling stage. In early May, 1998, as plants were in the first true leaf stages, cotyledons were sprayed with a suspension of field harvested downy mildew spores and screened for downy mildew resistance. Plants were grown in a germination chamber at a constant 20 degrees with sixteen hours of light and eight hours of darkness. Plants were screened twice, once at ten days and again at fourteen days post inoculation.

Fourteen seedlings were selected from each of four lines and screened as follows:

Line	Resistant	Susceptible	
3796-1	9	4	$X^{2=}$ 3:1 segregation ratio
3796-2	14	0	
3796-3	11	3	$X^{2=}$ 3:1 segregation ratio
3796-4	13	1	

Exhibit A

Breeding History

Data on crosses 3796-1 and 3796-3 indicate that a single dominant allele confers mildew resistance in 9602. However, 3796-2 and 3796-4 indicate a level of variability exists in 9602 for mildew resistance as indicated in the notice of release by Dr. Michelmore.

After screening, the downy mildew susceptible plants were removed and destroyed. Resistant plants were transferred to Corcoran, California, transplanted, and grown to seed maturity. Seed was harvested in August, 1998 as follows:

F2 to F3	3796-1- 1	bs
	3796-1- 2	bs
	3796-1- 3	bs
	3796-1- 4	ws
	3796-1- 5	bs
	3796-1- 6	bs
	3796-1- 7	bs
	3796-1- 8	bs
	3796-2- 1	bs
	3796-2- 2	bs
	3796-2 3	bs
	3796-2- 4	bs
	3796-2- 5	bs
	3796-3- 1	bs
	3796-3- 2	bs
	3796-3- 3	bs
	3796-3- 4	bs
	3796-3- 5	bs
	3796-3- 6	bs
	3796-3- 7	bs
	3796-3- 8	bs
	3796-3- 9	ws
	3796-3- 10	ws
	3796-4- 1	bs
	3796-4- 2	bs
	3796-4- 3	bs
	3796-4- 4	ws

In the fall of 1998, a breeder trial including 3796 material was planted near Yuma, Arizona. The trial was seeded on September 28, 1998 on the Silva Farms Otondo Ranch in Wellton, Arizona. The trial was evaluated on January 3, 1999.

Exhibit A

Breeding History

The line 3796-1-8 had several plants that exhibited highly desirable characteristics, and were dug from the field and transported to Coachella, California. The root balls were transplanted into five-gallon pots and grown to seed maturity in a mesh-covered screenhouse. Seed of I.D. 3796-1-8S1 (black seed) was harvested on April 24, 1999.

On April 30, 1999, seeds of 3796-1-8S1 were started in petrie dishes in Salinas, California. Seven seedlings were transplanted to soil blocks on May 09, 1999. On May 12, 1999, the seedlings were sprayed with a field mixture of downy mildew spores and evaluated ten and fourteen days post inoculation. Five susceptible plants were removed and destroyed, and the remaining two non-sporulating seedlings were transported to Corcoran, California and transplanted into a seed production nursery and raised to seed maturity. Seed of 3796-1-8S1-1 and 3796-8S1-2 was harvested in late August, 1999.

Trials of the parental line 3796-1-8 continued throughout the summer and fall of 1999 in the Salinas Valley of California to observe field performance and evaluate for heading, bolting, corky root, mildew resistance, tipburn resistance, and color.

Trials again continued of 3796-1-8S1-1 and 3796-1-8S1-2 in the fall of 1999 near Yuma, Arizona. Trials were seeded on September 24, 1999 of the f_4 lines on Silva Farms Posey Lot 127 in Wellton, Arizona. This trial was evaluated in late December and was very favorable for heading type, low core height, and smooth butt appearance. Results indicated that the material should be trialed in the Salinas Valley and screened for corky root and downy mildew resistance.

Trials were planted and evaluated in the Salinas Valley through the spring, summer, and fall of 2000.

On April 22, 2000 a trial was planted near Gonzales, California that was particularly important in the development of "Exp. 8512." This trial, Violini Herold 26, was evaluated on July 01, 2000 under conditions that tested the resistance of downy mildew and corky root. The line 3796-1-8S1-2 exhibited excellent heading, dark green color, corky root resistance, and a level of resistance to the field strain of downy mildew that was sporulating on the field variety Sharpshooter. Two plants were dug from this line and transplanted to Corcoran, California and grown to seed maturity. Seed was harvested from the two plants with the designation "2-2-1" and "2-2-2" on September 24, 2000.

Seed color of both plants were black.

Exhibit A

Breeding History

In April, 2001, a small experimental seed increase was planted using the single plant selection "2-2-2" near Corcoran, California. A small sample of live seed of "2-2-2" was mixed with a small quantity of dead seed and pelleted so that the stock seed could be precision planted in the seed field. The experimental composite was designated "Exp. 8512".

Trials of the new line were conducted in the Salinas Valley during the spring, summer, and fall of 2001 to evaluate performance and adaptability.

In 2002, a second crop of "Exp. 8512" was produced near Corcoran, California.
Seed of "Exp. 8512" was harvested in August of 2002, and grow outs conducted in Yuma, Arizona in December of 2002. Grow out evaluations were very promising for uniformity to type, bolt tolerance, and tipburn resistance. No corky root or downy mildew was noted in the desert trials. Trials were also conducted in the Salinas Valley of California in the summer of 2002 with remnant stock seed and results were very favorable for type (uniform Salinas type), mildew resistance (resistant), bolt tolerance (slow bolting) and corky root resistance (resistant) as compared to Silverado, Durango, and Sniper.

Grand Slam was developed by a hand pollinated cross followed by five generations of single seed descent and three generations of mass selection.

Grand Slam has been observed for three generations of reproduction and during the seed increase period and is stable and uniform. No variants were observed.

On April 16, 2002 the name Grand Slam was reserved with the United States Department of Agriculture.

Exhibit A

Breeding History

Pedigree ***Exp. 8512*** ***Grand Slam***

Hallmark W *(cor), ws* x 9602 *(R 32/Dm 18), mo), bs* 1997

↓

3796

1	2	3	4	1997 – 1998
1,2 bs *4 ws* *5-8 bs*	1-5 bs	1-8 bs 9,10 ws	1-3 bs 4 ws	

↓

3796-1-8S1 *1999*

↓

3796-1-8S1-2 *1999*

↓

2-2-2 (3796-1-8S1-2-2) *2000*

↓

Exp. 8512 *2001*

↓

Exp. 8512 **Grand Slam** *2002*

RELEASE OF LETTUCE BREEDING LINES - DECEMBER 1996.

Four groups of advanced breeding lines of lettuce are available for use by plant scientists and breeders in public and private institutions. All lines were developed by Richard Michelmore and Oswaldo Ochoa at University of California, Davis in collaboration with Ed Ryder at USDA/ARS, Salinas. When this germplasm contributes to a new cultivar, appropriate recognition should be given as to its origin.

These lines have been developed to provide superior disease resistance in a Salinas horticultural type by backcrossing to either cv. Salinas or cv. Salinas 88. The pedigrees of these lines is attached; additional details to those given below can be found in the annual reports of California Iceberg Lettuce Research Program. These lines are close to horticultural types suitable for use in the coastal production areas of California. However, there is residual variation in most of these lines and further selections may be required to fix plant type. Trails and selections should be made to determine specific areas and seasons to which these lines are best adapted.

The first group of four lines has downy mildew resistance originating from a breeding line with cv. Kordaat in its pedigree and have downy mildew resistance due to *Dm1* and *Dm4* as well as *Dm8* from cv. Salinas (Fig. 1). This combination of genes currently protects against many but not all California isolates of downy mildew. These genes have been combined with corky root resistance from Greenlakes.

The second group of 16 related lines originated from a cross with *Lactuca serriola*, PIVT1309, and contain *Dm15* as well as *Dm8* from Salinas (Fig. 2). Again, these lines are resistant to many but not all California isolates of downy mildew. *Dm15* provides resistance to a different spectrum of isolates than the *Dm1* plus *Dm4* combination. (Note: it is difficult to combine *Dm1* with *Dm15* as they are in the same linkage group and therefore tend to be genetically mutually exclusive.) This resistance has also been combined with corky root resistance from Greenlakes.

One line originated from a resistant breeding line originating from the National Vegetable Research Station (now Horticulture Research International), Wellesborne, UK from an accession of *Lactuca saligna* that was resistant to all European downy mildew isolates tested. We have backcrossed this resistance into the Salinas type (Fig. 3). This resistance remains effective against all the California isolates that we have tested, although it will probably be overcome in time by changes in the pathogen. This resistance is currently designated resistance factor 32 (R32) until its genetics is more fully characterized, at which time it will be assigned a *Dm* gene number.

The fourth group of four lines have resistance to anthracnose from one of two sources (Fig. 4). The cv. Salad Bowl source provides resistance against most of the California isolates tested that resulted from the 1982/1983 epidemic. The *Lactuca saligna* source, UC83US1, provides resistance against all California isolates tested. As this disease has not been problematic recently we have not had more current isolates to test against.

Figure 3: Pedigree of lines carrying R32 and mo.

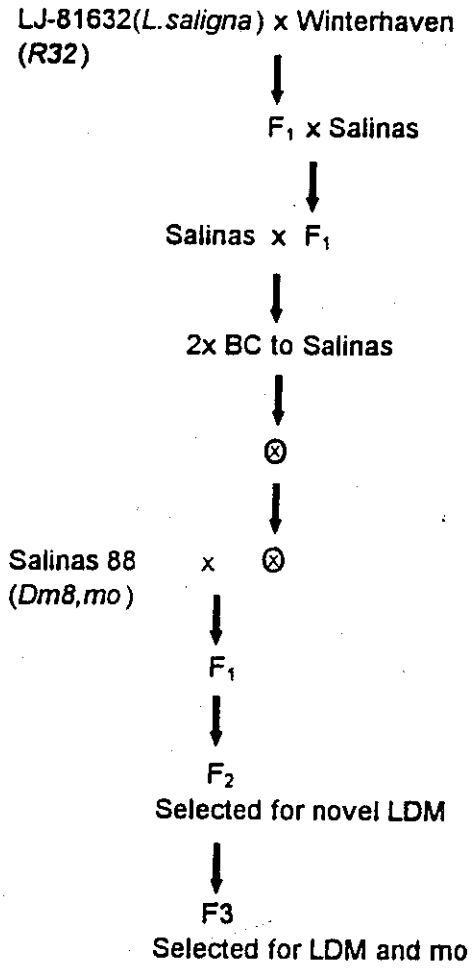


Figure 4: Pedigree of lines carrying anthracnose resistance from two different sources.

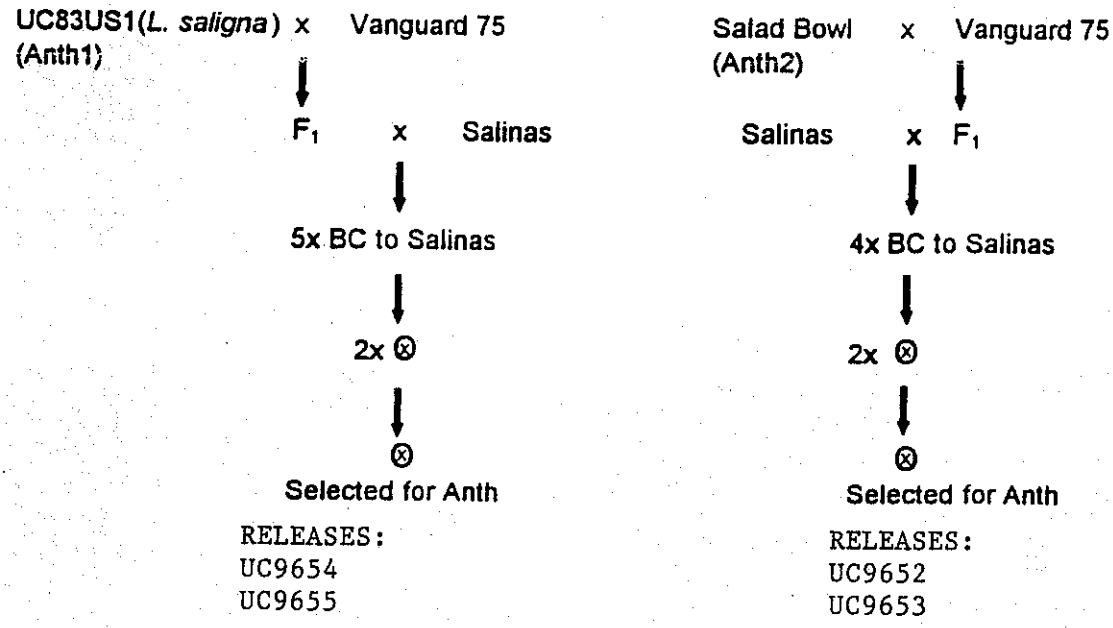
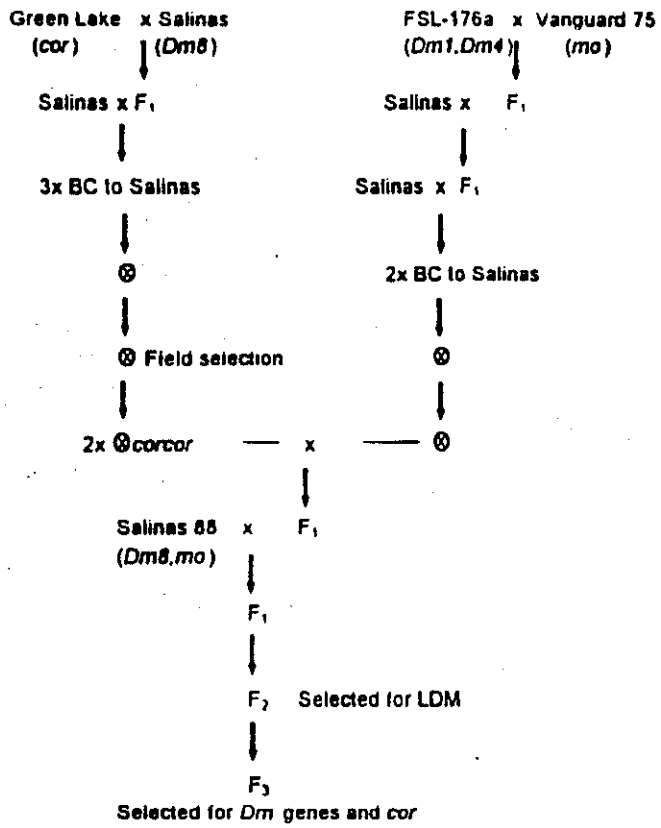
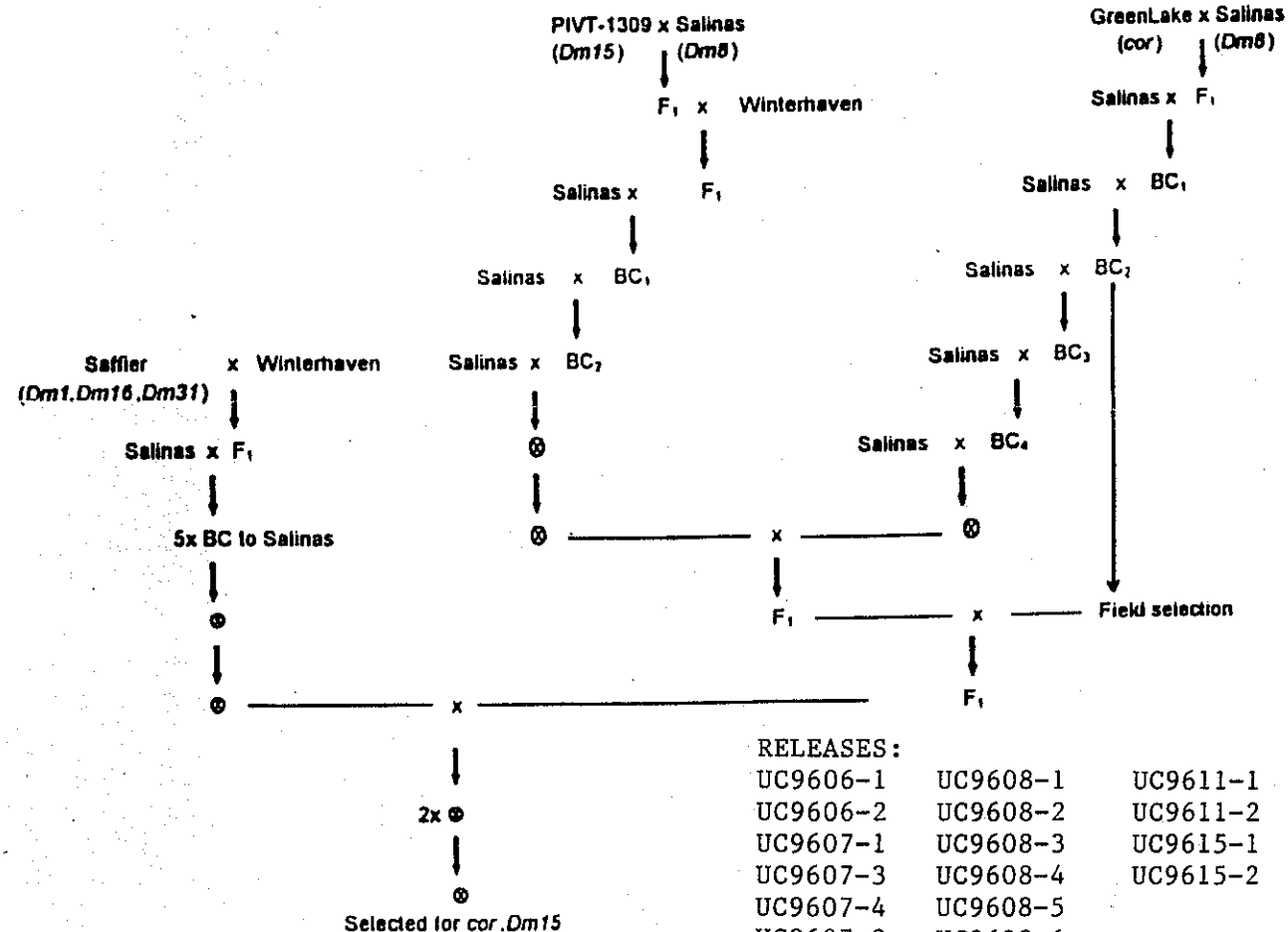


Figure 1: Pedigree of lines carrying *Dm1*, *Dm4*, *Dm8*, *mo* and *cor*



RELEASES:
UC9612
UC9614-1
UC9614-2
UC9620
UC9657
UC9659

Figure 2: Pedigree of lines carrying *Dm15* and *cor*.



RELEASES:

UC9606-1	UC9608-1	UC9611-1
UC9606-2	UC9608-2	UC9611-2
UC9607-1	UC9608-3	UC9615-1
UC9607-3	UC9608-4	UC9615-2
UC9607-4	UC9608-5	
UC9607-2	UC9608-6	

Table 3. Virulence phenotypes of isolates of *B. lactucae* currently being used to select for breeding lines resistant to downy mildew.

		(CAIIa) C83P24	(CAIIb) C91D36	C93D14	Isolate C97O592	C98648ED	C99O706	C98O696
Cultivar / Line	*Dm* / R factor	1,4,11, 15,16,18	4,15,18	15	4,16	4	(18), A[a]	(18)
				Avirulence phenotype				
Lednicky	1	-	+	+	+	+	+	+
UCDM2	2	+	+	+	+	+	+	+n
Dandie	3	+	+	+	+	+	+	+n
R4/T57E	4	-	-	+	-	-	+/(-)	+n
Valmaine	5/8	+n	+	+n	+n	+	+	+n
Sabine	6	+	+	+	+	+	+	+n
LSE57/15	7	+n	+	+n	+	+	+	+n
UCDM10	10	+n	+	+n	+	+	+	+n
Capitan	11	-	+	-	+	+	+	+n
Hilde	12	+n	+	+n	+	+	+	+n
Empire	13	+n	+	+n	+	+	+	+n
UCDM14	14	+n	+	+	+	+	+	+n
PIVT1309	15	-n	-	-	+	+	+	+n
LSE18	16	-/(-)n	-n	+n	-/(-)n	+	+n	+n
LSE 12	17	-n	-	-	-	-	-	-
Mariska	18	-n	-	-n	-/(-)	(-)/-	-	-n
El Dorado	18	-	-	(-)/-	+/(-)	+/(-)	-	-/(-)n
UC9602	R32	-	-	-	(-)/-	-/(-)	-	-/(-)
Colorado	18sec?	-	-	(-)/-	+/(-)	(-)	-	-
Ninja	R36	-	-/(-)n	-	+/(-)	(-)	+/(-)/-	(-)/+/-
Discovery	R37	-	-	-	-	-	-	-
Argeles	R38	-/(-)	-	-/(-)	(-)/-	-/(-)	-/(-)	(-)/+
Amplus	2,4,?[a]	+/(-)	-	+	-	-	-	+
Cobham Green	none	+	+	+	+	+	+	+

+ = susceptible reaction. - = resistant reaction. n = necrosis. (-) = some delayed sporulation associated with necrosis.

[a] Reaction on Amplus is not consistent with *Dm* genes known to be present; there may be an additional gene in Amplus active against this isolate.

Corky Root: Crosses have been made to introduce corky root resistance (*cor*) into the green leaf, red leaf, and butterhead types. The *cor* gene is being introduced into these types from a corky root resistant crisphead breeding line (UC99G301). Backcrosses will be made this year. We have identified molecular markers (see separate report) that will allow the rapid identification of lines carrying *cor*. For the romaine type, 'Tall Guzman', a corky root resistant cultivar is being used as a recurrent parent, therefore introduction of *cor* from a non-romaine type is not necessary.

Exhibit B

Statement of Distinctness

Home Run

Grand Slam most closely resembles the variety Home Run, however:

Grand Slam and Home Run are resistant to California Downy Mildew pathotypes I, IIA, III, IV, V, and VI. This resistance is conferred by Dm genes 1, 4, 11, 15, 16, and 18.

Grand Slam and Home Run are resistant to Corky Root. Corky root (CR) is caused by the bacterium Rhizomonas suberfaciens (gen.nov,sp.nov) (van Bruggen et al., 1990). The common strain found in California is identified as CA 1.

Seed color of Grand Slam is black, whereas, seed color of Home Run is white (silver).

Leaf surface color of Grand Slam is 144A, whereas, leaf color of Home Run is 144B.

Legacy

Grand Slam is resistant to Corky root (cor gene), whereas, Legacy is susceptible to Corky root.

Grand Slam contains the Dm18/R32 gene, whereas, Legacy does not carry the mildew resistance of Dm18/R32.

Legacy is a medium large sized iceberg lettuce comparable to the variety Salinas. Legacy is best adapted to late spring and fall harvest in California coastal areas. Under warmer summer production conditions, Legacy can be large and puffy with elongated cores similar to the variety Salinas. Grand Slam is best suited to late spring, summer and fall harvest in California coastal production areas.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION

EXHIBIT C

OBJECTIVE DESCRIPTION OF VARIETY
LETTUCE *Lactuca sativa*

NAME OF APPLICANT (S)
Paragon Seed, Inc.

ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code)
507 Abbott Street
Salinas, California 93901

FOR OFFICIAL USE ONLY
PVPO NUMBER 200300215

VARIETY NAME
Grand Slam

EXPERIMENTAL DESIGNATION
Exp. 8512

Place numbers in the boxes for the characters which best describe this variety. Measured data should be the mean of an appropriate number (at least 10) of well spaced plants. Royal Horticultural Society or any recognized color standard may be used to determine plant colors.

The location of the test area is: Salinas, California

Color System Used: Royal Horticultural Society

1. PLANT TYPE: *(See list of suggested check varieties page 4.)*

[0 6]

01=Cutting/Leaf
02=Butterhead
03=Bibb
04=Cos or Romaine
05=Great Lakes Group
06=Vanguard Group
07=Imperial Group
08=Eastern (Ithaca) Group
09=Stem
10=Latin
11=OTHER

2. SEED:

COLOR: [2] 1=White (Silver Gray) 2=Black (Gray Brown) 3=Brown (Amber)

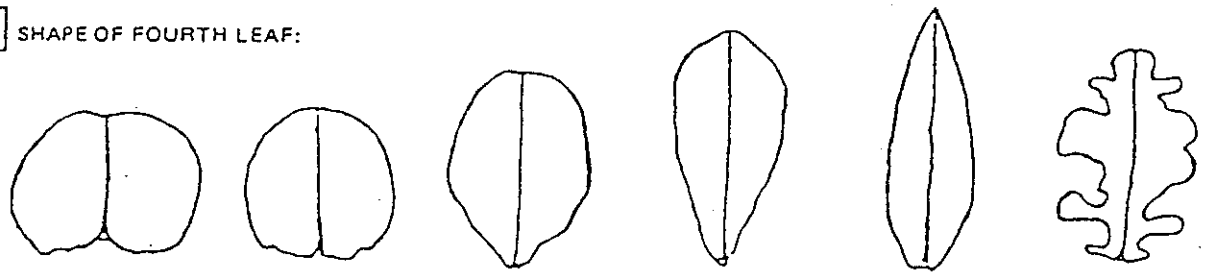
LIGHT DORMANCY: [2] 1=Light Required 2=Light Not Required

HEAT DORMANCY: [1] 1=Susceptible 2=Not Susceptible

3. COTYLEDON TO FOURTH LEAF STAGE: NOTE: Provide a color photograph or photocopy of the fourth leaf from 20 day old seedling grown under optimal conditions.

[2] SHAPE OF COTYLEDONS: 1=Broad 2=Intermediate 3=Spatulate

[2] SHAPE OF FOURTH LEAF:



1 2 3 4 5 6

[1 3] LENGTH/WIDTH INDEX OF FOURTH LEAF: L/W x 10

[1] APICAL MARGIN: [4] BASAL MARGIN: 1=Entire 2=Crenate/Gnawed 3=Finely Dentate 4=Moderately Dentate 5=Coarsely Dentate 6=Incised 7=Lobed 8=OTHER *(specify)*

[2] UNDULATION: 1=Flat 2=Slight 3=Medium 4=Marked

[3] GREEN COLOR: 1=Yellow Green 2=Light Green 3=Medium Green 4=Dark Green 5=Blue Green 6=Silver Green 7=Gray Green

ANTHOCYANIN:

[1] DISTRIBUTION: 1=Absent 2=Margin Only 3=Spotted 4=Throughout 5=OTHER *(specify)*

[0] CONCENTRATION: 1=Light 2=Moderate 3=Intense

[1] ROLLING: 1=Absent 2=Present

[2] CUPPING: 1=Uncupped 2=Slight 3=Markedly

[1] REFLEXING: 1=None 2=Apical Margin 3=Lateral Margins

20030215

4. MATURE LEAVES *(observe harvest-mature outer leaves)*:

NOTE: Provide color photo of harvest-mature leaves which accurately shows color and margin characteristics.

MARGIN:

[2]	INCISION DEPTH: *(deepest penetration of the margin)*	1=Absent/Shallow (Dark Green Boston)	2=Moderate (Vanguard)	3=Deep (Great Lakes 659)
[4]	INDENTATION: *(finest divisions of the margin)*	1=Entire (Dark Green Boston) 2=Shallowly Dentate (Great Lakes 65)	3=Deeply Dentate (Great Lakes 659) 4=Crenate (Vanguard)	5=OTHER *(specify)*
[2]	UNDULATION OF THE APICAL MARGIN:	1=Absent/Slight (Dark Green Boston)	2=Moderate (Vanguard)	3=Strong (Great Lakes 659)
[3]	GREEN COLOR:	1=Very Light Green (Bibb) 2=Light Green (Minetto)	3=Medium Green (Great Lakes) 4=Dark Green (Vanguard)	5=Very Dark Green 6=OTHER

ANTHOCYANIN *(grown at or below 10 C)*:

[1]	DISTRIBUTION:	1=Absent 2=Margin Only (Big Boston)	3=Spotted (Calif. Cream Butter) 4=Throughout (Prize Head)	5=OTHER *(specify)*
[1]	CONCENTRATION:	1=Light (Iceberg)	2=Moderate (Prize Head)	3=Intense (Ruby)
[2]	SIZE:	1=Small	2=Medium	3=Large
[2]	GLOSSINESS:	1=Dull (Vanguard)	2=Moderate (Salinas)	3=Glossy (Great Lakes)
[1]	BLISTERING:	1=Absent/Slight (Salinas)	2=Moderate (Vanguard)	3=Strong (Prize Head)
[3]	LEAF THICKNESS:	1=Thin	2=Intermediate	3=Thick
[1]	TRICHOMES:	1=Absent (smooth)	2=Present (spiny)	

5. PLANT *(at market stage. Choose a comparison variety appropriate for this type.)*:

[4][0] SPREAD OF FRAME LEAVES: cm This Variety [3][7] cm Home Run *(specify comparison variety)*

[1][8] HEAD DIAMETER *(market trimmed with single cap leaf)*: cm This Variety [1][6] cm Home Run *(specify comparison variety)*

[3] HEAD SHAPE: 1=Flattened, 2=Slightly Flattened, 3=Spherical, 4=Elongate, 5=Non-Heading, 6=OTHER

[3] HEAD SIZE CLASS: 1=Small, 2=Medium, 3=Large

[2][4] HEAD COUNT PER CARTON

[7][3][7] HEAD WEIGHT: g This Variety [7][0][3] g Home Run Akita Ranch Gonzales, Ca. May/02 *(specify comparison variety)*

[3] HEAD FIRMNESS: 1=Loose, 2=Moderate, 3=Firm, 4=Very Firm

6. BUTT *(bottom of market-trimmed head)*:

[2] SHAPE: 1=Slightly Concave, 2=Flat, 3=Rounded

[1] MIDRIB: 1=Flattened (Salinas), 2=Moderately Raised, 3=Prominently Raised (Great Lakes 659)

7. CORE *(stem of market-trimmed head)*:

[4][2] mm Diameter at base of head

[4][2] Ratio of head diameter/core diameter

[3][2] Core height from base of head to apex: mm This Variety [3][3] mm Home Run *(specify comparison variety)*

8. BOLTING *(Give First Water Date 4/15/02)*: NOTE: First Water Date is the date seed first receives adequate moisture to germinate. This can and often does equal the planting date.

[6][3] Number of days from First Water Date to seed stalk emergence *(summer conditions)*: This Variety [6][5] Home Run *(specify comparison variety)*

[3] BOLTING CLASS: 1=Very Slow, 2=Slow, 3=Medium, 4=Rapid, 5=Very Rapid

[9][2] Height of mature seed stalk: cm This Variety [9][0] cm Home Run *(specify comparison variety)*

BOLTING cont'd. on next page

20030215

Spread of Bolter Plant *(at widest point)*:

[4][5] cm This Variety [4][3] cm Home Run *(specify comparison variety)*

[1] BOLTER LEAVES: 1=Straight 2=Curved

[2] MARGIN: 1=Entire 2=Dentate

[2] COLOR: 1=Light Green 2=Medium Green 3=Dark Green

BOLTER HABIT:

[2] TERMINAL INFLORESCENCE: 1=Absent 2=Present

[1] LATERAL SHOOTS: *(above head)* 1=Absent 2=Present

[1] BASAL SIDE SHOOTS: 1=Absent 2=Present

9. MATURITY *(earliness of harvest-mature head formation)*:

NOTE: Complete this section for at least one season.

SEASON	Applic. 1/ #of days	Check 1/ #of days	CHECK VARIETY 2/
Spring	90	88	Home Run
Summer	65	64	Home Run
Fall	78	76	Venus
Winter	96	96	Valley Queen

Give planting date(s), and location(s):

Spring	Greenfield, Ca.	Salyer American	02-15-02	05-15-02
Summer	Salinas, Ca.	Bengard Ranches	05-30-02	08-02-02
Fall	King City, Ca.	Rava Ranches	08-06-02	10-22-02
Winter	Wellton, Arizona	Silva Farms	10-01-02	01-05-03

1/ First water date to harvest. 2/ Fill in check variety name on the appropriate line.

10. ADAPTATION:

PRIMARY REGIONS OF ADAPTION *(tested and proven adapted)*: (0=Not tested 1=Not Adapted 2=Adapted)

[2] Southwest *(Calif., Ariz. desert)* [2] West Coast [0] Northeast

[0] Northcentral [0] Southeast [ ] OTHER _____

SEASON:

[2] Spring (area Salinas, Santa Maria) [2] Fall (area Salinas, Santa Maria California)

[2] Summer (area Salinas, Santa Maria Ca) [0] Winter (area _____)

[0] GREENHOUSE: 0=Not tested 1=Not Adapted 2=Adapted

[1] SOIL TYPE: 1=Mineral 2=Organic 3=Both

11. DISEASES AND STRESS REACTIONS (0=Not tested; 1=Susceptible; 2=Intermediate; 3=Resistant; 4=Highly Resistant; 5=Tolerant)

CA I

RAD 10/26/05

VIRUS

- [1] Big Vein
- [0] Lettuce Mosaic
- [0] Cucumber Mosaic
- [0] Broad Bean Wilt
- [0] Turnip Mosaic
- [0] Beet Western Yellows
- [0] Lett. Infectious Yellows
- [ ] Other Virus ______

FUNGAL/BACTERIAL

- [3] Corky Root Rot (Pythium Root Rot)
- [3] Downy Mildew (Races R 32)
- [0] Powdery Mildew
- [1] Sclerotinia Rot
- [0] Bacterial Soft Rot (Pseudomonas spp. & others)
- [0] Botrytis (Gray Mold)
- [ ] OTHER ______

INSECTS

- [0] Cabbage Loopers
- [1] Root Aphids
- [1] Green Peach Aphid
- [ ] Other Insect ______

PHYSIOLOGICAL/STRESS

- [1] Tipburn
- [2] Heat
- [0] Drought
- [0] Cold
- [0] Salt
- [0] Brown Rib (Rib Discoloration, Rib Blight)
- [ ] OTHER ______

POST HARVEST

- [1] Pink Rib
- [1] Russet Spotting
- [0] Rusty Brown Discoloration
- [0] Internal Rib Necrosis (Blackheart, Gray Rib, Gray Streak)
- [0] Brown Stain

12. BIOCHEMICAL OR ELECTROPHORETIC MARKERS:

13. COMMENTS:

SUGGESTED CHECK VARIETIES

TYPE	CHECK VARIETY
1) CUTTING/LEAF	SALAD BOWL
2) BUTTERHEAD	DARK GREEN BOSTON
3) BIBB	BIBB
4) COS, OR ROMAINE	PARRIS ISLAND
5) GREAT LAKES GROUP	GREAT LAKES 659-700
6) VANGUARD GROUP	VANGUARD
7) IMPERIAL GROUP	VIVA
8) EASTERN GROUP	ITHACA
9) STEM	CELTUCE
10) LATIN	MATCHLESS

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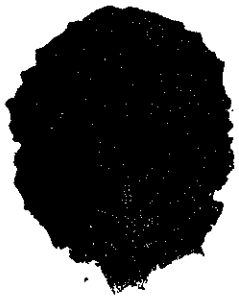
Paragon Seed, Inc.

Photocopy of Leaf Margin

Grand Slam



Home Run

Photocopy of fourth leaf from 20 day old plant grown under optimum conditons

GRAND SLAM Exp. 8512

GRAND SLAM Exp. 8512

Exhibit D

Additional Information for the Variety

Grand Slam is a medium large framed, medium to large headed crisphead type lettuce best adapted for late spring, summer and early fall harvest in the coastal areas of California. Under normal growing conditions, Grand Slam develops round, well shaped heads suitable for wrap, naked pack, or into bins for processing. The textural quality (leaf thickness) of the head is very good, with excellent creamy yellow internal color. Under warmer than normal growing conditions, the core height may be slightly elongated. Under cooler than normal growing conditions, head size may be small. Butt appearance is smooth to slightly dished similar to "Salinas" types. The butt appearance of varieties like Sniper and Sharpshooter tend to be pointed with coarse, pronounced ribs that are slightly raised. Grand Slam is medium green in color, not as dark as Sharpshooter, Sniper, or Durango, yet darker in color than Hallmark W and Home Run.

Grand Slam is unique in its combined resistance to Corky Root (cor) and Lettuce Downy Mildew resistance factor (*Dm* 18/R32). The *Dm*18/*R*32 resistance factor is from the U.C. / U.S.D.A. breeding line 9602. The line 9602 is not commercially acceptable due to susceptibility to tipburn, bolting, and variability of heading. The line was released by the UC/USDA is 1996 so that breeders could introgress new, unique and novel resistance genes into new varieties in an effort to help growers control lettuce downy mildew without the use of chemicals. The closest commercially available cultivar to Grand Slam with this Dm18/R 32 source of mildew resistance is Home Run.

Durango (Coastal Seeds, Inc,)

Seed color of Durango is tan. Seed color of Grand Slam is black.
Leaf color of Durango is 143A, whereas the leaf color of Grand Slam is 144A.

Home Run (Paragon Seed, Inc.)

Seed color of Grand Slam is black, whereas the seed color of Home Run is white (silver).
Leaf color of Grand Slam is 144A, whereas the leaf color of Home Run is 144B.

Telluride (Coastal Seeds, Inc.)

Seed of Telluride is tan. Seed color of Grand Slam is black.
Leaf color of Telluride is 143B, whereas the leaf color of Grand Slam is 144A.

Silverado (Coastal Seeds, Inc.)

Seed color of Silverado is tan. Seed color of Grand Slam is black.
Leaf color of Silverado is 143B, whereas the leaf color of Grand Slam is 144A.
Silverado is susceptible to Corky Root, whereas Grand Slam is resistant.

Exhibit D

Additional Information for the Variety

Notes on Dm18/R32 genes for Downy Mildew Resistance.

At the time the cross was made in 1997, we were confident that the resistance factor R32 released from U.C. Davis would confer resistance to downy mildew not available in resistant varieties with Dm 18. As we worked our way into the selection and disease screening process, it became evident that the R32 factor presented inconsistencies in sporulating populations. Samples of downy mildew were sent to U.C. Davis for characterization with results that helped bring to their attention that isolates of downy mildew that overcame Dm 18 also overcame lines carrying resistance factor R32. At U.C. Davis, markers characteristic of lines carrying Dm 18 were also present in lines carrying R32. Multiple isolates have a parallel pattern of reactions on lines carrying Dm 18 and R 32 although reactions on Dm 18 may differ in their reaction and there may be differences in intensity of sporulation. The conclusion from U. C. Davis is that Dm 18 and R 32 seem to be functionally identical. This is surprising as the two resistances were apparently derived from different lactucae species; Dm 18 was derived from L. serriola and R 32 from L. saligna. This appears to be a case of independent introgression of the same resistance specificity multiple times.

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Lettuce Downy Mildew Screening Procedures

Paragon Seed, Inc. 2005

BACKGROUND

Downy Mildew is caused by the fungus-like organism *Bremia lactucae.* Infection occurs when wind, seed, or soil-borne spores (oospores or sporangia) germinate on leaves in the presence of free moisture or relative humidity near saturation when temperatures are cool to moderate (40 to 86 degrees F). High and low temperatures extend the latent period and slow disease development, but extended periods of morning leaf wetness favor infection. The pathogen survives between lettuce crops in and on lettuce seeds, pathogenically on wild Lactuca ssp., and soil-borne oospores, but wind blown spores can also be important in disease development, especially in the Salinas Valley and Santa Maria Valley of California.

On mature lettuce leaves, downy mildew symptoms first appear as angular, variably sized light green or light yellow lesions, but later become yellow or necrotic. Lesions are often bounded by large veins. When temperatures are moderate and humidity is high, sporulation is evident on leaves, especially on the lower sides of leaves. Older lesions become brown and necrotic. Severe infections can kill seedlings, but adult plants are rarely killed. Early infections can also become systemic and cause a dark brown discoloration of vascular tissues. Low levels of infection can downgrade the crop, causing significant trimming losses at harvest, and promoting decay during post-harvest storage. High levels of downy mildew can cause an entire crop to be unmarketable.

Paragon Seed, Inc. relies heavily on downy mildew resistant Lactuca sativa introductions and information provided by the University of California at Davis. As new genetics are released and available, genes are introgressed into Paragon Seed, Inc. germplasm, and screens are conducted to identify susceptibility and/or resistance in new breeding lines. In the case of Downy Mildew Resistance Screening, backcross and single seed descent strategies are employed in early generation breeding.

PROCEDURES

The following procedures are followed to screen lettuce breeding lines for "field" downy mildew resistance.

Seed of breeding lines with potential downy mildew resistance genes are identified and organized in the laboratory.

Lettuce Downy Mildew Resistance Screening 2005

Standard plastic greenhouse flats of 128 cells (8 x 16) are filled with commercially available sterilized potting soil, and pre-moistened prior to seeding.

Once the tray has been staked as per a pre-determined map, two seeds of each breeding line are placed in each cell.

Trays are mist watered to runoff, covered, and placed in a germination chamber (20 degrees C., 8 hours light, 16 hours dark) until germination occurs.

Trays are then moved outdoors, and plants grown until the first true leaf has emerged.

Our "common" downy mildew screen utilizes a mixture of field harvested downy mildew spores from various growing areas and varieties. Infected leaves are collected from commercial production fields. The leaves are returned to the lab, washed using distilled water, and then loosely layered on moist paper towels in a sealed plastic bag. The sealed bag is then placed overnight in the dark in a refrigerated growth chamber (10 °C). Twenty four hours later, leaves are removed from the growth chamber and the fresh downy mildew spores are gently misted to runoff. The spores are collected, filtered and then ready for inoculation.

The spore solution is then sprayed onto the lettuce seedlings using a Badger micro air-brush sprayer using pressurized 1,1 diflouroethane propellant.

The trays are again placed into plastic bags and returned to the growth chamber for twenty four hours at 10 °C.

The following day the plants are removed from the growth chamber and grown outdoors for a period of eight to ten days.

After a minimum of eight days, the plants are watered, placed into plastic bags, and returned to the growth chamber for twenty four hours in the dark at 10°C.

The plants are removed from the growth chamber after twenty four hours and are visually inspected for the presence of sporangiophores. Plants that show visible sporulation are removed and destroyed. Trays can be returned to the growth chamber for an additional dark cycle if necessary.

Resistant plants are noted and recorded and either transplanted to the greenhouse or seed field for seed increase or destroyed.

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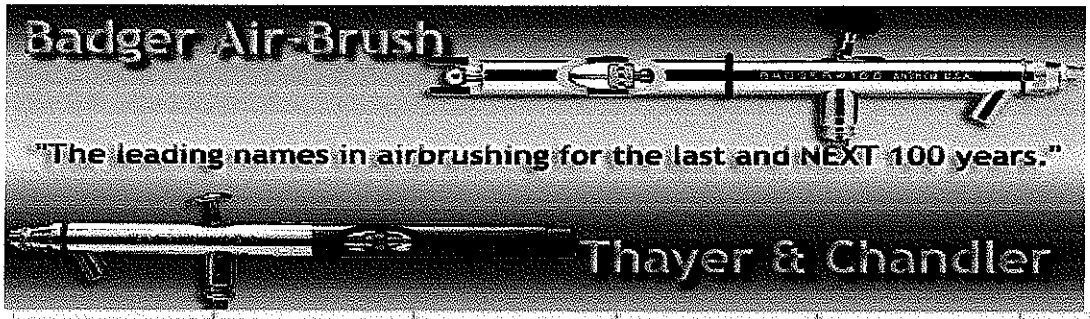
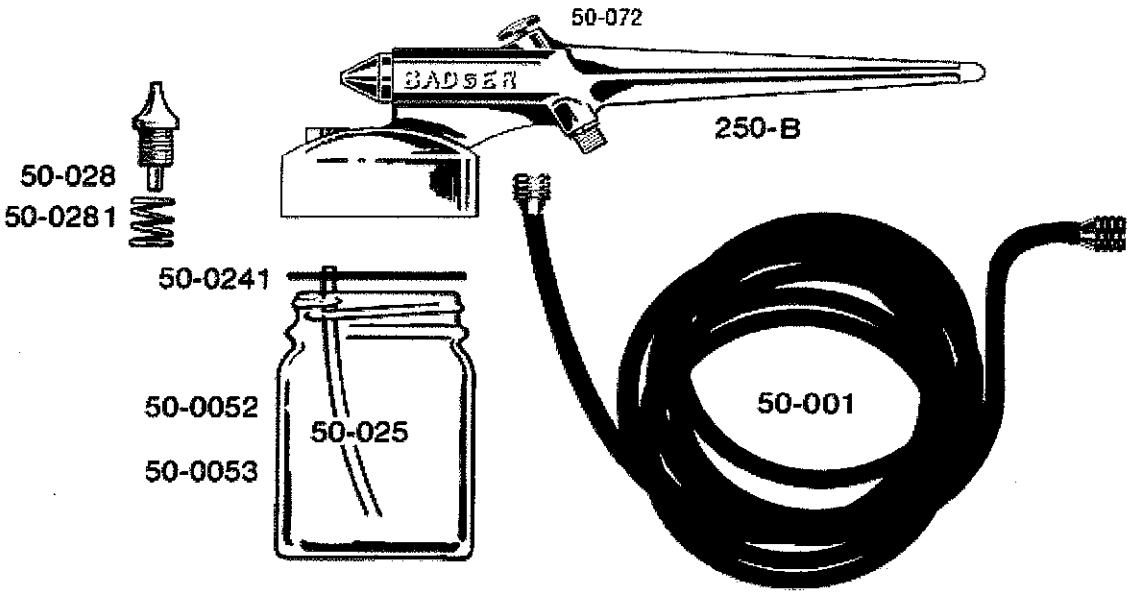


MODEL 250



Part # Description

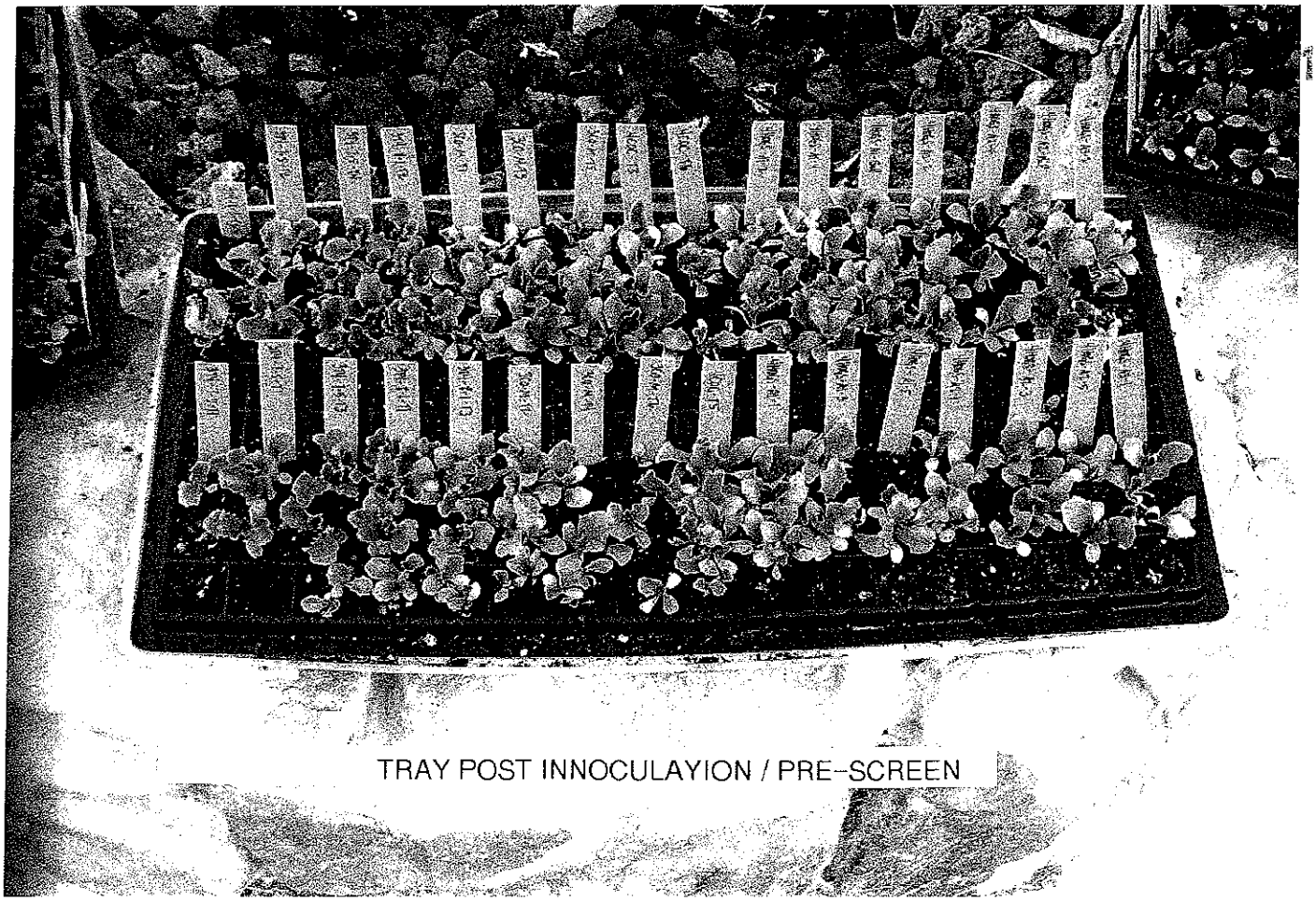
50-028 Paint Tip and Spring

50-241 Gasket

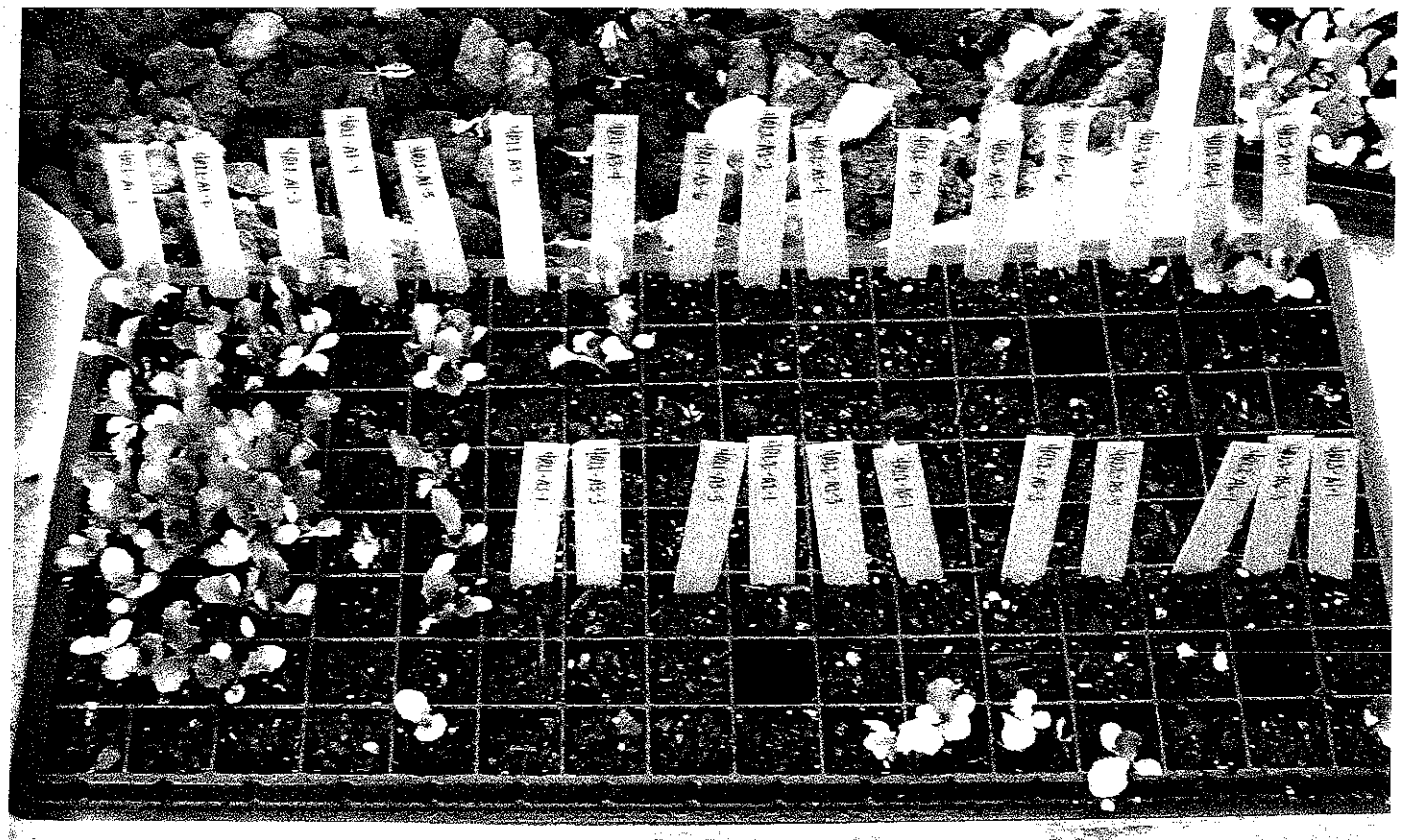
50-0052 ¾ oz. Jar and Cover

50-0053 2 oz. Jar and Cover

50-025 Paint Hose



TRAY POST INNOCULAYION / PRE-SCREEN



TRAY POST INNOCULAYION / POST SCREEN

CALIFORNIA LETTUCE RESEARCH PROGRAM

April 1, 1999 to March 31, 2000

PROJECT TITLE: **LETTUCE BREEDING**

PRINCIPAL INVESTIGATORS: **Richard W. Michelmore**
Oswaldo E. Ochoa
Department of Vegetable Crops
University of California, Davis
rwmichelmore@ucdavis.edu
oeochoa@ucdavis.edu

COOPERATING PERSONNEL: **Sean Fort**
Mikal Saltviet
Department of Vegetable Crops
University of California, Davis
Edward J. Ryder
UDSA-ARS, Salinas

OBJECTIVES:

1) To produce advanced crisphead breeding lines which have resistance to multiple diseases, superior appearance and quality, high yielding ability, uniform maturity, and are slow bolting.

2) To determine the genetic inheritance of agriculturally important traits, particularly disease resistance.

3) To identify new genes for disease resistance in wild germplasm and incorporate them into advanced breeding lines.

PROCEDURES AND RESULTS:

Trials of Breeding Lines

The program continues the strategy of crosses and early generations being grown at Davis with later generations being trailed and selected at several different lettuce growing areas in collaboration with Dr Ed Ryder. Backcross or modified single-seed descent strategies are being employed for most early generations. We continue to select for good color, slow bolting, and yield as well as disease resistance in Salinas and Vanguard plant types. Further crosses and selections were made to the four groups of lines released in the spring of 1997 to generate lines with multiple disease resistances. Multiple disease screening for lettuce downy mildew (LDM), corky root(CR) and lettuce mosaic virus (LMV) continues.

Two trials were planted in 1999 and two in early 2000 at the USDA Spence field station in collaboration with Ed Ryder. These trials contained twenty-five lines each carrying novel sources of resistance to LDM and resistance to CR. In addition, two trials were planted with Ed Ryder in commercial fields in the Salinas valley.

Releases

During the coming year we plant to release lines containing resistance to the most common Californian pathotypes and some of the common novel types. We will release lines combining *Dm4* and *Dm15* with resistance to corky root (*cor*), lettuce mosaic virus (*mo1*), and anthracnose (*Ant1*). These lines will be resistant to the most common isolates of downy mildew including Pathotype V, but not all isolates. *Dm18*/R32 will be released in combination with the above genes.

It was brought to our attention that isolates of downy mildew that overcame *Dm18* also overcame lines that we had recently released carrying the new resistance R32. Furthermore, markers characteristic of lines carrying *Dm18* were also present in lines carrying R32. We have investigated this further and agree with these observations. Multiple isolates have a parallel pattern of reactions on lines carrying *Dm18* and R32; although reactions on *Dm18* are not always easy to evaluate and even lines that are thought to contain *Dm18* may differ in their reaction and there may be differences in intensity of sporulation (Table 1). Molecular markers specific to the *Dm3* gene family also failed to distinguish lines carrying *Dm18* and R32 (Fig. 1). Therefore we conclude that *Dm18* and R32 seem to functionally identical. This is surprising as the two resistances were apparently derived from different species; *Dm18* was derived from *L. serriola* and R32 from *L. saligna.* We have never worked with *Dm18* in our crisphead breeding program. This appears to be a case of independent introgression of the same resistance specificity multiple times. When *Dm18* has been cloned, it will be interesting to see

Table 1. Virulence phenotypes of isolates used to characterize *Dm18* and R32.

		(CAIIa)	(CAIIb)		Isolate of *B. lactucae*				
		C83P24	C91D36	C93D14	C97O592	C98648ED	C99O706	C98O696	C99O776
Cultivar / Line	*Dm1* / R factor	1,4,11, 15,16,18	4,15,18	15	4,16	4	18	(18)	(0)[a]
					Avirulence phenotype				
Mariska[b]	18	-n	-	-n	*	*	-	-n	*
El Dorado	18	-	-	*	*	*	-	*	*
Colorado	18	-	-	*	*	+	-	-	*
UC9602	R32	-	-	*	*	*	-	*	*
Discovery	R37	-	-	-	-	-	-	-	-
Cobham Green	R0	+	+	+	+	+	+	+	+

+ = profuse sporulation, susceptible reaction. - = no sporulation, resistant reaction. n = necrosis.
* = some sporulation, often delayed and associated with necrosis.
[a] This isolate sporulates as profusely as any California isolate on lines carrying *Dm18*. However, sporulation on *Dm18* carry lines is never as profuse as on Cobham Green.
[b] Mariska may have additional genes.

whether the nucleotide sequences are identical or divergent between *Dm18* and R32. The practical implication of this result is that unfortunately R32 does not provide a new spectrum of resistance and can be used interchangeably with *Dm18*. There is no reason to try to combine these resistances.

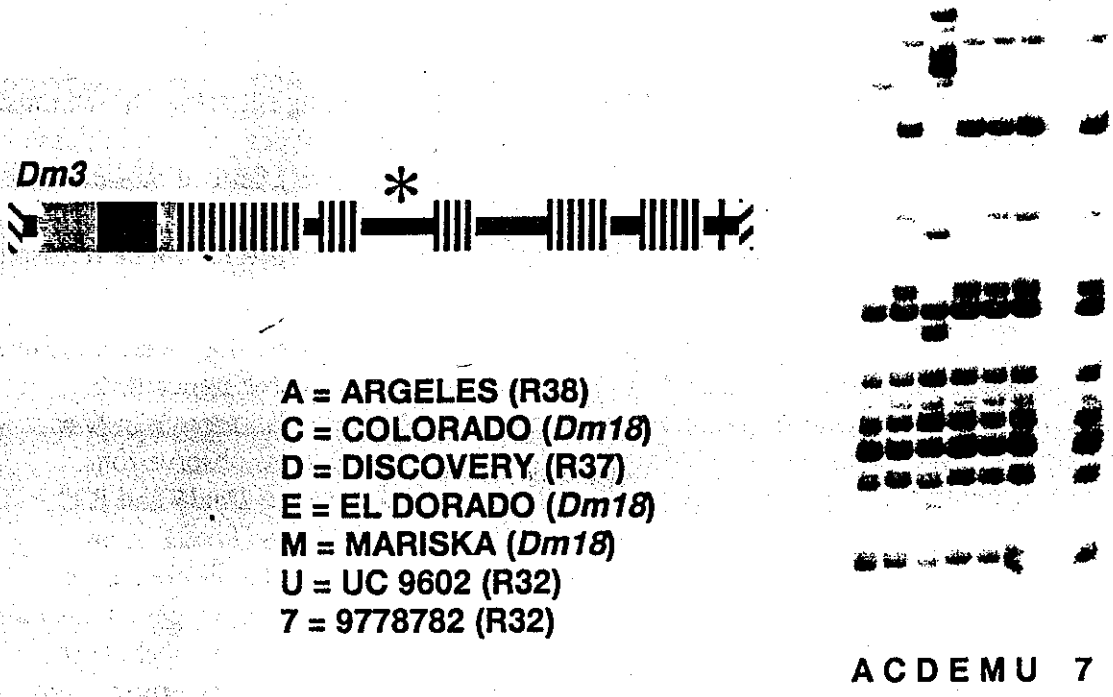


Figure 1. Molecular diagnosis of *Dm18* and R32 using the microsatellite marker MSAT15-34 that is located within homologs of the *Dm3* gene (*).

Development of Disease Resistant Lines

Downy mildew: We are continuing to develop lines with resistance genes from diverse sources to provide protection against downy mildew in California. We have three groups of breeding lines: Lines with combinations of known *Dm* genes. 2) Advanced lines with new resistance genes. 3) Breeding lines with recently identified new resistance genes. In all cases we are using backcrossing strategies to introduce these genes into coastal lettuce types and to combine them with other disease resistance genes.

The recent increase in diversity of downy mildew in California is making the generation of lines that are resistant to all California isolates of downy mildew more difficult. We are continuing to maximize the number of different resistance genes being introduced so that the lettuce crop is not dependent on one or a few genes. We have

CALIFORNIA ICEBERG LETTUCE RESEARCH PROGRAM

April 1, 1996, to March 31, 1997

PROJECT TITLE: **LETTUCE BREEDING**

PRINCIPAL INVESTIGATORS: **Richard W. Michelmore**
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COOPERATING PERSONNEL: **Vince Rubatzky**
Gavin Henderson
Department of Vegetable Crops
University of California, Davis
Edward J. Ryder
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PROCEDURES AND RESULTS:

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The program continues the strategy of crosses and early generations being conducted at Davis with later generations being trailed and selected at several different lettuce growing areas. Backcross or modified single seed descent strategies are being employed for most early generations. We continue to select for good color, slow bolting, and yield as well as disease resistance in Salinas and Vanguard plant types.

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Two trials were planted in 1996 and two in early 1997 at the USDA Spence field station in collaboration with Ed Ryder. These trials contained some lines carrying novel sources of resistance to downy mildew. In addition, four trials were planted with Ed Ryder in commercial fields in the Salinas valley. Also, Vince Rubatzky included several of our lines in his trials of commercial cultivars in the Salinas and Santa Maria valleys. These trials included lines with resistance to corky root and new sources of resistance for downy mildew. Selection for desirable horticultural types were made. Further backcrosses to selected plants were made at Davis.

Releases

Seed for four groups of advanced germplasm were released in the spring of 1997. Thirty-two requests were received. A total of 27 lines were distributed to each request. Most of these lines have multiple disease resistances. Six lines had *Dm1*, *Dm3*, *Dm8* and *cor*; these lines are resistant to most but not isolates of downy mildew as well as corky root (Table 1). Sixteen lines had *Dm8* and *Dm15* as well as *cor*. One line had R32; only this line is resistant to all isolates of downy mildew tested (Table 1). Four lines had resistance to anthracnose but no additional resistance to downy mildew. The status of resistance to LMV of several of these lines remains to be determined. All have the Salinas plant type and have been selected for color and size as well as for disease resistance in trials in the coastal valleys of California. They have varying amounts of residual heterogeneity and therefore can either be used as parents for crosses or selection of lines adapted to specific areas and seasons. Details of these lines and their pedigrees are available in the 1995-1996 CILRP report or by contacting us directly at the above address.

Table 1. Resistance reactions of 1996 releases inoculated with California isolates.

		Pathotype or virulence phenotype[a]							
Release number	*Dm* gene[b]	II	III	IV	V	N0	N4	N18	N4,15
UC9612, 9614, 9620	*Dm1*, *Dm4*	-	-	-	-	+	-	+	-
UC9606 to 8, 9611, 9615	*Dm15*	-	-	-	+	+	+	+	-
UC9652 to 5		+	+	+	+	+	+	+	+
UC9602	R32	-	-	-	-	-	-	-	-
Frequency 1995 - 1997[c]		15	3	12	23	3	12	7	8

[a] Pathotypes II to V as described previously. N indicates isolates on novel virulence phenotype; # indicates the *Dm* genes that are effective against these isolates.

[b] All have cv. Salinas genetic background, therefore should also contain *Dm8* (not confirmed).

[c] 1996 and 1997 frequency data biased by non-random sampling.

We anticipate another set of lines will be released in 1998. Some will contain *Dm4* combined with *Dm15* as well as corky root resistance. This combination of *Dm* genes will be effective against many, although not all, isolates of downy mildew currently in California. Additional lines with R32; only one line was homozygous and therefore available for release in

1997. More homozygous lines with this resistance are being generated. R32 remains effective against all Californian isolates of downy mildew that we have tested it against. We also are aiming to release lines with additional new sources of resistance.

Development of Disease Resistant Lines

Downy mildew: We are continuing to develop lines with resistance genes from diverse sources to provide protection against downy mildew in California. We have three groups of breeding lines: 1) Lines with combinations of known *Dm* genes. 2) Advanced lines with new resistance genes; the first of these lines has been released (see above). 3) Early-generation breeding lines with recently identified new resistance genes. In all cases we are using backcrossing strategies to introduce these genes into coastal lettuce types.

We conducted field trials and further backcrosses over the past year (Table 2). The recent increase in diversity of downy mildew in California (see below) is making the generation of lines that are resistant to all California isolates of downy mildew more difficult. We are therefore maximizing the number of different resistance genes being introduced so that the lettuce crop is not dependent on one or a few genes. We have continued the backcross programs to introgress resistance from ten of the 77 new sources of resistance described in the 1994 CILRP report. We are determining the number of resistance genes present in these accessions.

Table 2. Status of Backcross Programs to Introduce Resistance to Downy Mildew.

Effective Resistance Genes	Source	Current Status
Dm4 + *Dm15* (+ *Dm8*)	Kordaat	BC_7, field trials at UCD & Salinas
	PIVT1309	To be released 1998.
Dm11 + *Dm16* (+ *Dm8*)	Breeding Line	BC_6 S_2 crossed with other resistances
R32 (+ *Dm8*)	*L. saligna*	Released 1997. More releases in 1998. Combining with other resistances.
Uncharacterized (+ *Dm8*)	*L. serriola*	BC_7 S_1, BC_4 S_3 selections in field
Uncharacterized (+ *Dm8*)	*L. saligna*	BC_7 S_1, BC_4 S_3 selections in field
Uncharacterized (+ *Dm8*)	*L. virosa*	BC_6 S_2
New from PI491226 (+ *Dm8*)	*L. sativa*	BC_4 to Salinas
New from PI491108 (+ *Dm8*)	*L. serriola*	BC_4 to Salinas
New from PI491206 (+ *Dm8*)	*L. saligna*	BC_4 to Salinas
New from PI491208 (+ *Dm8*)	*L. saligna*	BC_3 to Salinas
New from W66336A (+ *Dm8*)	*L. saligna*	BC_3 to Salinas
New from Israel (+ *Dm8*)	*L. saligna*	BC_3 to Salinas
New from CGN9311	*L. saligna*	BC_2 to Salinas
New from CGN5318	*L. saligna*	BC_2 to Salinas
New from CGN5282	*L. saligna*	BC_2 to Salinas
New from CGN5147	*L. saligna*	BC_2 to Salinas

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AMERICAN TAKII

301 Natividad Road · Salinas, California 93906
Phone: 831-443-4901 · Fax: 831-443-3976
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Lettuce Legacy

LETTUCE LEGACY

DESCRIPTION:	Medium large-sized head, deep green in color, Iceberg type
MATURITY:	Early/medium
COMPARABLE VARIETIES:	Salinas types
CULTURAL CHARACTERISTICS:	Legacy has vigorous growth and produces large, uniform heads with good wrap under low temperatures. Growing season is late spring and fall.
ADAPTABILITY:	Arizona, California

FEATURES	BENEFITS
• Strong cold tolerance	• Early season harvest
• Good uniformity and wrap	• Desirable market qualities
• Crisp, large heads	
• Vigorous growth	

10/04

HIGHLIGHTS
Of Agricultural Research

Volume 44 Number 2

Summer 1997

CAN TASTY LETTUCE BE GROWN IN ALABAMA?

Amy Simonne, Eric Simonne, John Owen, Larry Wells, and Ron Eitenmiller

It is often said that lettuce grown in Alabama is too bitter because of the weather, and that red lettuce is more bitter than green. An AAES study assessing bitterness by sensory evaluation in various types of lettuce revealed that acceptable quality and good tasting lettuce can be grown in Alabama.

Presently, commercial production of lettuce in the United States exceeds 205,000 tons annually, and is mainly located in California. Although lettuce is a popular crop in home gardens, no commercial production of lettuce in Alabama exists. Main types of lettuce commercially available are (1) crisphead (iceberg) [head lettuce], (2) Romaine, (3) butterhead, and (4) leaf lettuce. Most people are familiar with iceberg lettuce because it is commonly sold in stores, but leaf lettuce is commonly grown by many home gardeners. In addition to variation in head shapes, lettuce with different foliage colors from traditional greens also are available.

Because the harvestable part of lettuce is a rosette of leaves, any foliar damage caused by insects, viruses, or fungi reduces marketability. The main objective of lettuce breeding programs is to produce lettuce resistant to several viruses and diseases. Resistant genes from wild *Lactuca* species are often used as sources of resistance to viruses and other diseases. However, incorporating resistant genes from *L. saligna* or *L. virosa* often lead to increased levels of sesquiterpene lactones which are the bitter compounds of the latex of the wild lettuce. Over 500 types of sesquiterpene lactones are present in Compositae plants. Little information exists on the relationship between bitterness and the sesquiterpene lactones levels and the lettuce acceptability.

Commercially available lettuce varieties (Table 1) were grown at the Wiregrass and Piedmont Substations following current fertilization and pest control recommendations. At maturity, lettuce was hand harvested, washed and cut into bite-size pieces similar to those found in tossed salads. Lettuce samples were served one by one to a group of 15 trained panelists. Panelists were trained prior to the tasting session. The training session consisted of providing each panelist with a series of caffeine solutions with increasing bitterness and their corresponding bitterness rating (0% = 0, 0.05% = 2, 0.08% = 5, 0.15% = 10 and 0.20% = 15). Hence, when the trained panelists were used, it was possible to quantify panelist response in numeric scores. Panelists were instructed to calibrate their taste using the caffeine solutions between each sample.

TABLE 1. Seed Source Head Types and Disease Claims of Selected Lettuce Varieties

Table 1. Seed Source, Head Types and Disease Claims of Selected Lettuce Varieties

Variety	Seed source	Head type	Leaf color	Disease claims
Big Curly	Vilmorin	Maraichere	Green	
Brunia	Vilmorin	Oakleaf	Green/Red	
Cabernet Red	Asgrow	Looseleaf	Red	
Epic	Sakata	Crisphead	Green	
Greengo	Asgrow	Looseleaf	Green	
Legacy	Takii	Crisphead	Green	
Nancy	SeedWay	Butterhead	Green	
Nevada	Vilmorin	Batavia	Green	DM,LMV,TB
Optima	Vilmorin	Butterhead	Green	DM, LMV
Parris Island	Stokes	Romaine	Green	TB
Redprize	Ferry-Morse	Looseleaf	Green/Red	TB
Red Salad Bowl	Vilmorin	Oakleaf	Red	
Salinas 88	Sakata	Crisphead	Green	LMV

Supreme				
Sierra	Vilmorin	Batavia	Green/Red	DM,TB,LMV
Slobolt M.I.	Harris Seeds	Looseleaf 'Frisee'	Green	
LMV=Lettuce Mosaic Virus; TB=Tip Burn; DM=Downy Mildew				

Mean, most frequent, lowest and highest scores for each lettuce variety and growing locations are presented in Table 2. Scores varied considerably between panelists. Although significant differences between varieties were found, 28% (five out of 18) of the entries were given the highest score of seven or less. Most prevalent scores were less than four, suggesting that the lettuce was not bitter or was very little bitter. Although, depending on the individual, bitterness scores of less than seven would be considered acceptable as commented by trained panelists. Panelists did not reject red or purple lettuce. Growing conditions seemed to affect bitterness scores. This study suggests that it is possible to grow non-bitter, pleasant tasting lettuce in Alabama. Future studies will focus on determining the impact of cultural practices and harvest dates on sensory attributes of lettuce.

Table 2. Sensory Evaluation of Bitterness in Lettuce Varieties[1]: Bitterness Score

Variety	Type	Location[2]	Mean score (n)	Most frequent	Lowest	Highest[3]
Epic	Head	WS	1.6(14)	1	0	6
Salinas	Head	WS	1.6(14)	0	0	4
Nevada	Batavia	PS	2.0(16)	0	0	9
Red Prize	Leaf	WS	2.2(14)	2	0	7
Legacy	Head	WS	2.3(14)	1	0	7
Sierra	Batavia	PS	2.5(16)	2	0	7
Nancy	Butterhead	WS	2.9(14)	3	0	10
Red Salad Bowl	Oakleaf	WS	3.2(14)	0	0	11
Brunia	Oakleaf	PS	3.3(16)	1	0	10
Cabernet Red	Leaf	WS	3.5(14)	2	1	13
Parris Island	Romaine	WS	3.6(14)	3	0	14
Slobolt M.I.	Leaf	WS	3.8(14)	2	0	10
Optima	Butterhead	WS	4.1(14)	2	0	12
Optima	Butterhead	PS	4.9(16)	0	0	13
Greengo	Leaf	WS	5.2(14)	5	1	15
Nancy	Butterhead	PS	8.4(16)	4	0	15
Big Curly	Maraichere	PS	9.3(16)	13	0	15
Slobolt M.I.	Leaf	PS	10.1(16)	15	1	15

Paragon Seed, Inc. Salinas, California May 2002 Martella Ranch

HOME RUN Exp. 1511

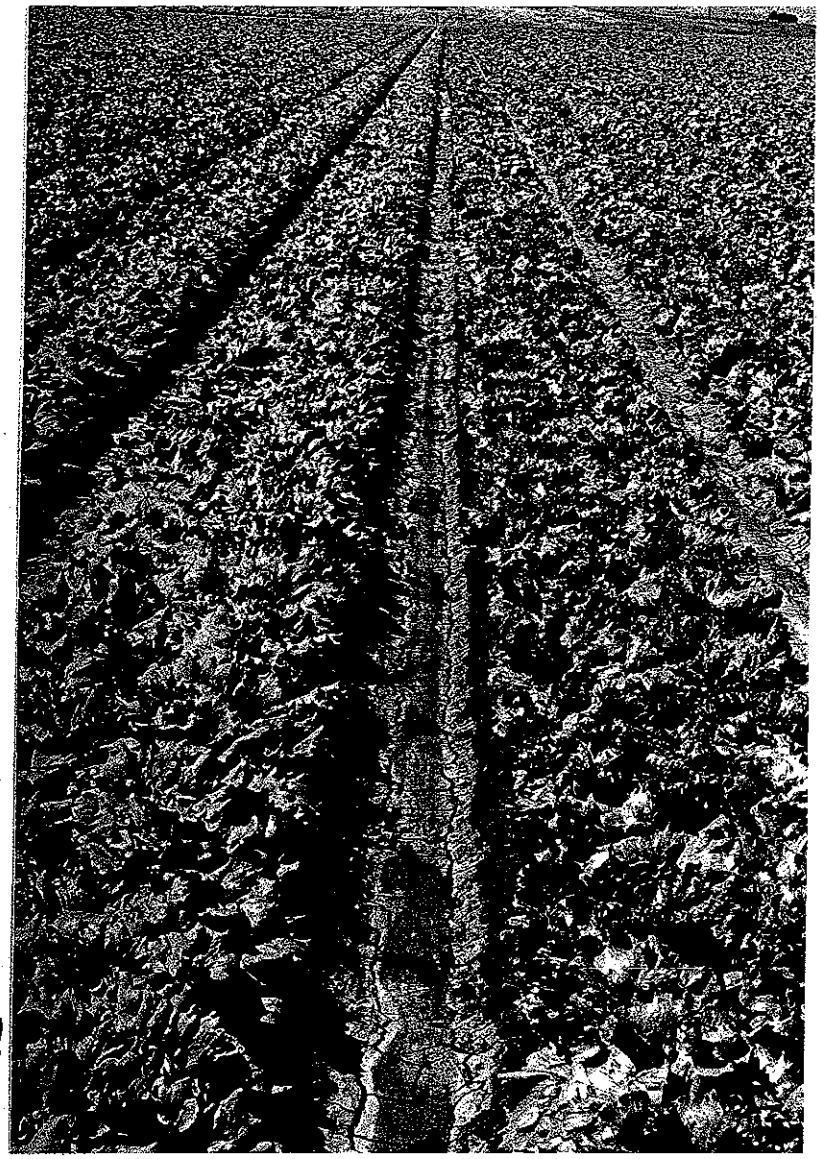
HOME RUN Exp. 1511

Paragon Seed, Inc. Salinas, California May 2002

SILVERADO Coastal Seed Field Planting

SILVERADO

Paragon Seed, Inc. Salinas, California May 2002 Martella Ranch



Grand Slam left bed Silverado right bed field planting

HOME RUN Exp. 1511

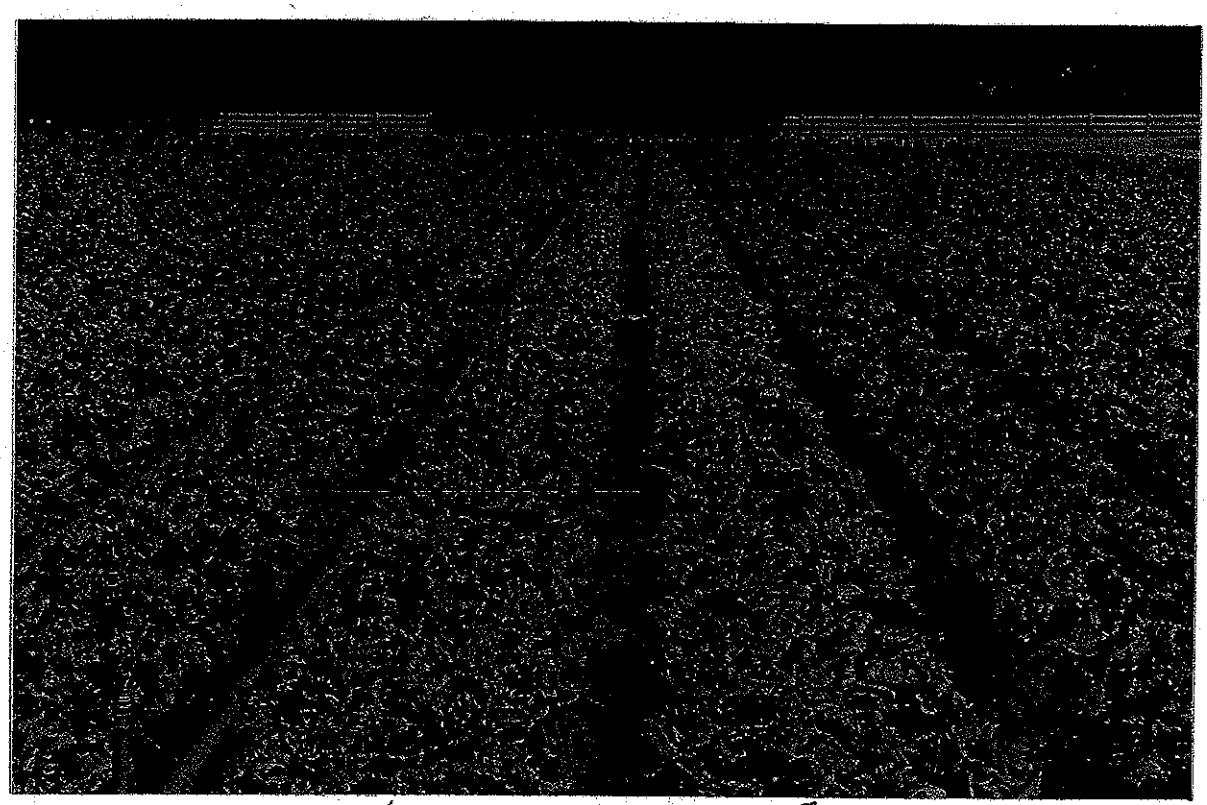
GRAND SLAM Exp. 8512

Paragon Seed, Inc. **Salinas, California** **May 2002** Leonardini

GRAND SLAM Exp. 8512

DURANGO Coastal Seeds

Paragon Seed, Inc. **Salinas, California** **May 2002** Leonardini



Field GRAND SLAM HOME RUN Field

Field Planting DURANGO

May 31, 2002 Buena Vista District Salinas Valley, California

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Home Run

Iwamoto-Moro Cojo

Harvest date: June 10, 2002

	Grand Slam Solidity	Home Run Solidity	Grand Slam Circum	Home Run Circum	Grand Slam Weight	Home Run Weight	Grand Slam Core Ht	Home Run Core Ht
Count	24	24	24	24	24	24	24	24
Sum	72.0	71.0	1,148.5	1,162.5	17,980.0	16,664.0	32.25	29.75
Mean	3.00	2.96	47.85	48.44	749.17	694.33	1.34	1.24
Maximum Value	3.5	3.0	52.0	51.0	908.0	863.0	1.75	1.50
Minimum Value	2.5	2.0	44.0	45.0	454.0	545.0	1.00	1.00
Variance	0.04	0.04	2.55	3.29	11,841.97	7,607.97	0.05	0.04
Std.Dev	0.21	0.20	1.60	1.81	108.82	87.22	0.22	0.20
Joint Variance	*****	0.04	*****	2.92	*****	9,724.97	*****	0.04
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	0.700	*****	1.182	*****	1.926	*****	1.71
Level of Significance	*****	.4877	*****	.2432	*****	.0603	*****	.0931
Confidence Level %	*****	51.227	*****	75.680	*****	93.972	*****	90.69
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	48.0	50.5	590	681	1.25	1.50
	3.0	3.0	47.0	51.0	681	863	1.25	1.25
	3.0	3.0	50.0	49.0	863	772	1.50	1.00
	3.0	3.0	47.0	45.0	636	545	1.25	1.00
Solidity measured on a scale of 1 to 5	2.5	3.0	44.0	48.0	454	726	1.00	1.25
	3.0	3.0	48.0	49.0	863	681	1.50	1.00
	3.5	3.0	49.0	49.0	863	636	1.50	1.00
	3.0	3.0	48.0	48.0	863	681	1.25	1.25
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	48.0	50.0	681	817	1.00	1.50
	3.0	3.0	49.0	51.0	817	772	1.50	1.25
	3.0	3.0	52.0	50.0	681	772	1.00	1.25
	3.0	3.0	48.0	48.0	681	726	1.25	1.50
	3.0	3.0	48.0	46.0	726	545	1.25	1.00
	3.0	3.0	47.0	51.0	726	772	1.00	1.50
	2.5	3.0	45.5	49.0	772	681	1.00	1.50
	3.0	3.0	48.0	49.0	726	636	1.50	1.00
	3.0	3.0	50.0	46.0	817	590	1.50	1.50
	3.0	3.0	48.0	48.0	908	636	1.50	1.25
	3.0	2.0	47.0	45.0	636	545	1.50	1.00
	3.0	3.0	48.0	50.0	772	772	1.50	1.50
	3.5	3.0	49.0	49.0	908	681	1.75	1.00
	3.0	3.0	47.0	47.0	772	636	1.50	1.25
	3.0	3.0	47.0	47.0	772	772	1.50	1.25
	3.0	3.0	46.0	47.0	772	726	1.50	1.25

letstat

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Home Run

Leonardini-Pozzi

Harvest date: May 31, 2002

	Grand Slam Solidity	Home Run Solidity	Grand Slam Circum	Home Run Circum	Grand Slam Weight	Home Run Weight	Grand Slam Core Ht	Home Run Core Ht
Count	24	24	24	24	24	24	24	24
Sum	74.0	77.5	1,104.0	1,095.5	17,345.0	17,028.0	34.50	39.25
Mean	3.08	3.23	46.00	45.65	722.71	709.50	1.44	1.64
Maximum Value	4.0	4.0	49.0	48.0	953.0	863.0	2.00	2.00
Minimum Value	3.0	3.0	42.0	41.0	454.0	545.0	1.00	1.00
Variance	0.06	0.17	4.46	3.71	17,908.22	10,178.52	0.10	0.07
Std.Dev	0.24	0.42	2.11	1.93	133.82	100.89	0.32	0.27
Joint Variance	*****	0.12	*****	4.08	*****	14,043.37	*****	0.09
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	1.485	*****	0.607	*****	0.386	*****	2.32
Level of Significance	*****	.1443	*****	.5466	*****	.7012	*****	.0250
Confidence Level %	*****	85.566	*****	45.336	*****	29.880	*****	97.50
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	4.0	48.5	46.0	863	863	1.75	1.75
	3.0	3.0	46.0	48.0	681	817	1.25	1.75
	3.0	4.0	48.0	46.0	772	817	1.50	1.75
	3.0	3.0	47.0	48.0	681	726	1.00	1.50
Solidity measured on a scale of 1 to 5	3.0	3.0	44.0	45.0	772	728	1.50	1.75
	3.0	3.0	46.0	48.0	817	817	1.50	1.50
	3.0	3.0	46.0	48.0	726	636	1.50	1.50
	3.0	4.0	48.0	46.0	863	726	1.00	2.00
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	43.0	45.0	636	545	1.25	1.00
	4.0	3.0	45.0	46.0	863	636	1.75	1.75
	3.0	3.0	42.0	48.0	545	681	1.25	1.75
	3.0	3.0	45.0	41.0	726	636	1.50	2.00
	3.0	3.0	47.0	47.5	817	681	2.00	1.75
	3.0	3.0	43.0	44.0	454	545	1.25	1.00
	3.5	3.5	47.5	44.0	953	772	1.75	1.75
	3.0	4.0	49.0	44.0	636	863	1.25	2.00
	3.0	3.0	48.0	46.0	681	545	1.25	1.50
	3.0	3.0	46.0	47.0	545	636	1.25	1.50
	3.0	3.0	45.0	44.0	908	681	2.00	1.50
	3.5	3.0	45.0	44.0	772	726	1.75	1.50
	3.0	4.0	49.0	44.0	636	726	1.25	2.00
	3.0	3.0	48.0	48.0	863	863	2.00	1.75
	3.0	3.0	46.0	43.0	636	772	1.00	1.50
	3.0	3.0	42.0	45.0	499	590	1.00	1.50

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PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Durango

Lazzerini-Castroville — **Harvest date: June 8, 2002**

	Grand Slam Solidity	Durango Solidity	Grand Slam Circum	Durango Circum	Grand Slam Weight	Durango Weight	Grand Slam Core Ht	Durango Core Ht
Count	24	24	24	24	24	24	24	24
Sum	71.0	76.5	1,172.5	1,135.0	18,840.0	19,976.0	30.75	36.00
Mean	2.96	3.19	48.85	47.29	785.00	832.33	1.28	1.50
Maximum Value	3.5	5.0	55.0	50.0	953.0	1,090.0	1.50	2.00
Minimum Value	2.0	2.0	44.0	44.0	454.0	636.0	1.00	1.00
Variance	0.06	0.32	5.73	2.65	21,932.00	14,257.54	0.05	0.06
Std.Dev	0.25	0.57	2.39	1.63	148.09	119.40	0.22	0.24
Joint Variance	*****	0.19	*****	4.19	*****	18,094.77	*****	0.06
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	1.808	*****	2.645	*****	1.219	*****	3.23
Level of Significance	*****	.0771	*****	.0112	*****	.2291	*****	.0023
Confidence Level %	*****	92.291	*****	98.885	*****	77.092	*****	99.77
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	48.0	47.0	817	953	1.50	1.50
	3.0	3.0	47.0	48.0	636	863	1.00	1.50
	3.0	3.0	52.0	50.0	953	953	1.00	1.50
	3.0	3.0	47.5	46.0	681	772	1.00	1.50
Solidity measured on a scale of 1 to 5	3.0	3.0	47.0	48.0	636	908	1.00	2.00
	3.0	2.0	49.0	48.0	772	636	1.50	1.50
	3.0	3.0	51.0	49.0	908	772	1.50	1.50
	3.5	3.0	51.0	44.0	908	772	1.50	1.00
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	49.0	49.0	908	908	1.25	1.50
	3.0	3.0	49.0	48.0	772	726	1.25	1.25
	3.0	5.0	48.0	49.0	772	1,090	1.25	1.50
	3.0	3.0	49.0	47.0	908	681	1.25	1.25
	3.0	4.0	46.0	49.0	908	953	1.25	2.00
	3.0	3.5	49.0	47.0	817	953	1.50	1.50
	3.0	4.0	50.0	49.0	953	953	1.50	1.25
	3.0	3.0	50.0	47.0	636	908	1.50	2.00
	3.0	4.0	50.0	45.0	953	772	1.50	1.75
	3.0	3.0	50.0	45.0	726	908	1.00	1.50
	2.0	3.0	45.0	45.0	454	772	1.00	1.25
	3.0	3.0	51.0	48.0	817	681	1.50	1.50
	3.0	3.0	49.0	49.0	908	863	1.50	1.50
	3.0	3.0	55.0	46.0	908	636	1.50	1.25
	3.0	3.0	44.0	46.0	590	726	1.00	1.50
	2.5	3.0	46.0	46.0	499	817	1.00	1.50

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Silverado

Leonardini-Pozzi — **Harvest date: May 31, 2002**

	Grand Slam Solidity	Silverado Solidity	Grand Slam Circum	Silverado Circum	Grand Slam Weight	Silverado Weight	Grand Slam Core Ht	Silverado Core Ht
Count	24	24	24	24	24	24	24	24
Sum	74.0	76.0	1,104.0	1,083.0	17,345.0	16,889.0	34.50	32.00
Mean	3.08	3.17	46.00	45.13	722.71	703.71	1.44	1.33
Maximum Value	4.0	4.0	49.0	48.0	953.0	999.0	2.00	1.75
Minimum Value	3.0	2.0	42.0	41.0	454.0	454.0	1.00	1.00
Variance	0.06	0.28	4.46	2.66	17,908.22	24,726.48	0.10	0.06
Std.Dev	0.24	0.52	2.11	1.63	133.82	157.25	0.32	0.24
Joint Variance	*****	0.17	*****	3.56	*****	21,317.35	*****	0.08
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	0.707	*****	1.607	*****	0.451	*****	1.27
Level of Significance	*****	.4831	*****	.1149	*****	.6543	*****	.2120
Confidence Level %	*****	51.693	*****	88.513	*****	34.574	*****	78.80
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	48.5	48.0	863	772	1.75	1.50
	3.0	4.0	46.0	46.0	681	908	1.25	1.50
	3.0	3.0	48.0	46.0	772	772	1.50	1.50
	3.0	2.0	47.0	41.0	681	454	1.00	1.00
Solidity measured on a scale of 1 to 5	3.0	3.0	44.0	43.0	772	545	1.50	1.00
	3.0	4.0	46.0	46.0	817	817	1.50	1.50
	3.0	3.0	46.0	45.0	726	545	1.50	1.00
	3.0	4.0	48.0	46.5	863	908	1.00	1.75
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	43.0	44.0	636	726	1.25	1.25
	4.0	3.0	45.0	45.0	863	545	1.75	1.50
	3.0	3.5	42.0	43.0	545	726	1.25	1.50
	3.0	3.0	45.0	44.0	726	545	1.50	1.25
	3.0	3.0	47.0	45.0	817	726	2.00	1.50
	3.0	3.0	43.0	43.0	454	545	1.25	1.25
	3.5	2.0	47.5	46.0	953	454	1.75	1.00
	3.0	3.0	49.0	43.5	636	590	1.25	1.00
	3.0	4.0	48.0	46.0	681	772	1.25	1.75
	3.0	3.0	46.0	47.0	545	726	1.25	1.25
	3.0	3.0	45.0	46.0	908	863	2.00	1.25
	3.5	3.5	45.0	46.0	772	908	1.75	1.50
	3.0	3.5	49.0	47.0	636	999	1.25	1.50
	3.0	3.0	48.0	46.0	863	681	2.00	1.25
	3.0	3.0	46.0	44.0	636	545	1.00	1.00
	3.0	3.5	42.0	46.0	499	817	1.00	1.50

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Cannery Row

Akita Ranch-Gonzales — **Harvest date: May 22, 2002**

	Grand Slam Solidity	Cannery Row Solidity	Grand Slam Circum	Cannery Row Circum	Grand Slam Weight	Cannery Row Weight	Grand Slam Core Ht	Cannery Row Core Ht
Count	24	24	24	24	24	24	24	24
Sum	72.0	70.5	1,109.5	1,123.0	17,706.0	17,115.0	30.50	30.45
Mean	3.00	2.94	46.23	46.79	737.75	713.13	1.27	1.27
Maximum Value	4.0	3.0	50.0	49.0	999.0	817.0	1.50	1.50
Minimum Value	2.5	2.0	42.0	42.0	454.0	499.0	1.00	1.00
Variance	0.07	0.05	4.56	3.89	13,322.20	8,508.90	0.04	0.05
Std.Dev	0.26	0.22	2.14	1.97	115.42	92.24	0.21	0.22
Joint Variance	*****	0.06	*****	4.23	*****	10,915.55	*****	0.05
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	0.901	*****	0.948	*****	0.816	*****	0.03
Level of Significance	*****	.3723	*****	.3482	*****	.4184	*****	.9733
Confidence Level %	*****	62.771	*****	65.179	*****	58.156	*****	2.67
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	2.5	3.0	46.0	47.5	681	817	1.00	1.50
	3.0	3.0	44.0	46.0	636	590	1.00	1.50
	3.0	3.0	49.0	43.5	863	681	1.25	1.50
	3.0	3.0	46.0	46.5	772	772	1.25	1.00
Solidity measured on a scale of 1 to 5	4.0	3.0	50.0	48.0	999	772	1.50	1.50
	3.0	3.0	47.0	47.5	772	817	1.00	1.00
	3.0	3.0	45.0	48.0	772	726	1.50	1.25
	3.0	3.0	46.0	44.5	681	681	1.25	1.50
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	47.0	46.5	772	545	1.50	1.20
	3.0	3.0	42.0	49.0	681	817	1.25	1.25
	3.0	3.0	49.0	48.0	817	772	1.50	1.50
	3.0	3.0	46.0	48.0	681	681	1.25	1.25
	3.0	3.0	49.0	43.0	863	636	1.25	1.50
	3.0	3.0	45.0	49.0	590	772	1.00	1.50
	3.0	3.0	47.0	48.0	908	636	1.25	1.00
	3.0	3.0	47.5	48.0	681	772	1.50	1.25
	3.0	3.0	46.0	48.0	726	726	1.50	1.00
	3.0	3.0	47.0	49.0	726	817	1.00	1.50
	2.5	3.0	42.0	42.0	454	499	1.00	1.00
	3.0	3.0	45.0	46.0	681	681	1.50	1.00
	3.0	3.0	48.0	49.0	726	772	1.00	1.50
	3.0	2.0	43.0	46.0	590	590	1.25	1.00
	3.0	2.5	45.0	45.0	817	817	1.50	1.25
	3.0	3.0	48.0	47.0	817	726	1.50	1.00

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Home Run vs Grand Slam

Akita Ranch-Gonzales — **Harvest date: May 22, 2002**

	Home Run Solidity	Grand Slam Solidity	Home Run Circum	Grand Slam Circum	Home Run Weight	Grand Slam Weight	Home Run Core Ht	Grand Slam Core Ht
Count	24	24	24	24	24	24	24	24
Sum	71.5	72.0	1,120.5	1,109.5	16,887.0	17,706.0	31.50	30.50
Mean	2.98	3.00	46.69	46.23	703.63	737.75	1.31	1.27
Maximum Value	3.5	4.0	52.0	50.0	953.0	999.0	2.00	1.50
Minimum Value	2.0	2.5	42.0	42.0	454.0	454.0	1.00	1.00
Variance	0.05	0.07	5.21	4.56	11,828.16	13,322.20	0.08	0.04
Std.Dev	0.23	0.26	2.28	2.14	108.76	115.42	0.29	0.21
Joint Variance	*****	0.06	*****	4.89	*****	12,575.18	*****	0.06
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	0.296	*****	0.718	*****	1.054	*****	0.58
Level of Significance	*****	.7688	*****	.4764	*****	.2973	*****	.5679
Confidence Level %	*****	23.123	*****	52.365	*****	70.268	*****	43.21
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	2.5	49.0	46.0	590	681	1.25	1.00
	3.0	3.0	45.0	44.0	590	636	1.00	1.00
	3.0	3.0	49.0	49.0	726	863	1.25	1.25
	3.0	3.0	46.0	46.0	681	772	1.75	1.25
Solidity measured on a scale of 1 to 5	2.0	4.0	44.0	50.0	454	999	1.00	1.50
	3.0	3.0	49.0	47.0	681	772	1.50	1.00
	3.5	3.0	48.0	45.0	953	772	1.75	1.50
	3.0	3.0	48.0	46.0	772	681	1.50	1.25
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	44.0	47.0	636	772	1.50	1.50
	3.0	3.0	46.0	42.0	726	681	1.25	1.25
	3.0	3.0	45.5	49.0	681	817	1.00	1.50
	3.0	3.0	47.0	46.0	681	681	1.25	1.25
	3.0	3.0	46.0	49.0	726	863	1.50	1.25
	3.0	3.0	48.0	45.0	863	590	2.00	1.00
	3.0	3.0	52.0	47.0	726	908	1.50	1.25
	3.0	3.0	46.0	47.5	726	681	1.50	1.50
	3.0	3.0	42.0	46.0	590	726	1.00	1.50
	3.0	3.0	44.0	47.0	545	726	1.00	1.00
	3.0	2.5	47.0	42.0	817	454	1.25	1.00
	3.0	3.0	48.0	45.0	681	681	1.00	1.50
	3.0	3.0	44.0	48.0	772	726	1.00	1.00
	3.0	3.0	50.0	43.0	863	590	1.50	1.25
	3.0	3.0	46.0	45.0	681	817	1.25	1.50
	3.0	3.0	47.0	48.0	726	817	1.00	1.50

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Sharpshooter

Bassetti-Greenfield — **Harvest date: May 16, 2002**

	Grand Slam Solidity	Sharp shooter Solidity	Grand Slam Circum	Sharp shooter Circum	Grand Slam Weight	Sharp shooter Weight	Grand Slam Core Ht	Sharp shooter Core Ht
Count	24	24	24	24	24	24	24	24
Sum	76.0	77.0	1,146.5	1,176.0	18,524.0	17,613.0	32.00	33.50
Mean	3.17	3.21	47.77	49.00	771.83	733.88	1.33	1.40
Maximum Value	4.0	4.0	53.0	53.0	999.0	953.0	2.00	2.25
Minimum Value	3.0	2.0	44.0	45.0	590.0	545.0	1.00	1.00
Variance	0.12	0.24	4.50	6.43	13,094.23	13,561.77	0.06	0.14
Std.Dev	0.35	0.49	2.12	2.54	114.43	116.45	0.25	0.37
Joint Variance	*****	0.18	*****	5.47	*****	13,328.00	*****	0.10
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	0.340	*****	1.821	*****	1.139	*****	0.69
Level of Significance	*****	.7354	*****	.0751	*****	.2606	*****	.4957
Confidence Level %	*****	26.457	*****	92.489	*****	73.939	*****	50.43
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	47.0	51.0	863	726	1.50	1.00
	3.0	3.0	53.0	50.0	908	772	2.00	1.75
	3.0	4.0	48.0	52.0	726	908	1.00	2.00
	3.0	3.0	52.0	52.0	908	681	1.50	1.00
Solidity measured on a scale of 1 to 5	3.0	3.0	47.0	47.0	636	726	1.25	1.00
	3.0	2.0	48.0	49.0	772	545	1.50	1.00
	3.0	4.0	49.0	52.0	953	863	1.25	2.25
	3.0	3.0	46.0	51.0	590	726	1.00	1.00
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.5	46.0	53.0	636	953	1.00	1.25
	3.0	3.0	44.0	47.0	590	590	1.50	1.50
	3.5	3.0	45.0	49.0	772	726	1.50	1.50
	3.0	3.0	47.0	46.0	681	726	1.25	1.50
	3.5	3.0	48.0	46.0	817	681	1.50	1.50
	4.0	3.0	51.0	46.0	999	590	1.50	1.00
	3.0	3.0	49.0	49.0	817	772	1.00	1.50
	3.0	3.0	46.0	46.0	681	590	1.00	1.25
	4.0	4.0	49.0	52.0	863	908	1.50	1.75
	3.0	3.0	49.0	46.0	772	545	1.00	1.00
	3.0	3.0	46.5	48.0	726	681	1.25	1.50
	3.0	3.0	46.0	52.0	726	681	1.50	1.00
	3.0	3.5	47.0	47.0	681	817	1.50	2.00
	4.0	3.0	47.5	51.0	863	772	1.50	1.50
	3.0	4.0	46.5	49.0	681	908	1.25	1.50
	3.0	4.0	49.0	45.0	863	726	1.25	1.25

PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Home Run

Bassetti-Greenfield — **Harvest date: May 16, 2002**

	Grand Slam Solidity	Home Run Solidity	Grand Slam Circum	Home Run Circum	Grand Slam Weight	Home Run Weight	Grand Slam Core Ht	Home Run Core Ht
Count	24	24	24	24	24	24	24	24
Sum	76.0	81.5	1,146.5	1,071.5	18,524.0	16,344.0	32.00	28.25
Mean	3.17	3.40	47.77	44.65	771.83	681.00	1.33	1.18
Maximum Value	4.0	4.0	53.0	48.0	999.0	908.0	2.00	1.75
Minimum Value	3.0	3.0	44.0	41.0	590.0	499.0	1.00	1.00
Variance	0.12	0.22	4.50	4.60	13,094.23	11,665.91	0.06	0.06
Std.Dev	0.35	0.47	2.12	2.14	114.43	108.01	0.25	0.24
Joint Variance	*****	0.17	*****	4.55	*****	12,380.07	*****	0.06
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	1.925	*****	5.076	*****	2.828	*****	2.21
Level of Significance	*****	.0604	*****	.0000	*****	.0069	*****	.0324
Confidence Level %	*****	93.958	*****	99.999	*****	99.308	*****	96.76
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	47.0	43.0	863	636	1.50	1.00
	3.0	3.0	53.0	43.0	908	636	2.00	1.00
	3.0	3.0	48.0	43.0	726	636	1.00	1.00
	3.0	3.0	52.0	41.0	908	499	1.50	1.00
Solidity measured on a scale of 1 to 5	3.0	4.0	47.0	46.5	636	817	1.25	1.50
	3.0	3.0	48.0	46.0	772	590	1.50	1.00
	3.0	3.5	49.0	46.0	953	726	1.25	1.00
	3.0	3.0	46.0	46.0	590	590	1.00	1.00
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	4.0	46.0	46.5	636	772	1.00	1.25
	3.0	4.0	44.0	46.0	590	772	1.50	1.25
	3.5	3.5	45.0	45.0	772	726	1.50	1.00
	3.0	4.0	47.0	47.0	681	772	1.25	1.00
	3.5	4.0	48.0	48.0	817	908	1.50	1.50
	4.0	4.0	51.0	47.5	999	772	1.50	1.50
	3.0	3.0	49.0	44.0	817	681	1.00	1.25
	3.0	3.0	46.0	41.0	681	499	1.00	1.00
	4.0	4.0	49.0	47.0	863	772	1.50	1.50
	3.0	3.0	49.0	44.0	772	681	1.00	1.00
	3.0	3.0	46.5	45.0	726	590	1.25	1.25
	3.0	4.0	46.0	42.0	726	636	1.50	1.00
	3.0	3.0	47.0	41.0	681	499	1.50	1.00
	4.0	3.0	47.5	44.0	863	681	1.50	1.75
	3.0	3.0	46.5	46.0	681	817	1.25	1.50
	3.0	3.5	49.0	43.0	863	636	1.25	1.00

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PARAGON SEED COMPANY

P.O. Box 1906 Salinas, Ca. 93902 831-753-2100

Grand Slam vs Silverado

Bassetti-Greenfield — **Harvest date: May 16, 2002**

	Grand Slam Solidity	Sliverado Solidity	Grand Slam Circum	Silverado Circum	Grand Slam Weight	Sliverado Weight	Grand Slam Core Ht	Sliverado Core Ht
Count	24	24	24	24	24	24	24	24
Sum	76.0	73.0	1,146.5	1,116.5	18,524.0	16,756.0	32.00	29.25
Mean	3.17	3.04	47.77	46.52	771.83	698.17	1.33	1.22
Maximum Value	4.0	3.5	53.0	51.0	999.0	863.0	2.00	1.75
Minimum Value	3.0	2.0	44.0	41.0	590.0	499.0	1.00	1.00
Variance	0.12	0.09	4.50	7.90	13,094.23	14,322.84	0.06	0.06
Std.Dev	0.35	0.29	2.12	2.81	114.43	119.68	0.25	0.25
Joint Variance	*****	0.10	*****	6.20	*****	13,708.54	*****	0.06
Jt Deg of Freedom	*****	46	*****	46	*****	46	*****	46.00
t-Test Parameter	*****	1.342	*****	1.739	*****	2.180	*****	1.59
Level of Significance	*****	.1863	*****	.0887	*****	.0344	*****	.1190
Confidence Level %	*****	81.370	*****	91.126	*****	96.555	*****	88.10
	1-5	1-5	Cm's	Cm's	Grams	Grams	Inches	Inches
MEASUREMENTS FOR SAMPLES	3.0	3.0	47.0	49.0	863	681	1.50	1.25
	3.0	3.0	53.0	47.0	908	726	2.00	1.00
	3.0	3.0	48.0	44.0	726	636	1.00	1.25
	3.0	3.0	52.0	44.5	908	681	1.50	1.00
Solidity measured on a scale of 1 to 5	3.0	3.5	47.0	47.0	636	817	1.25	1.00
	3.0	3.0	48.0	50.0	772	863	1.50	1.50
	3.0	3.5	49.0	50.0	953	863	1.25	1.75
	3.0	3.0	46.0	46.0	590	636	1.00	1.00
Note: The Level of Significance is determined by using Excel 5's 2-tail type 2 built in T-test function directly over the ranges of data.	3.0	3.0	46.0	44.0	636	545	1.00	1.00
	3.0	3.0	44.0	48.0	590	817	1.50	1.25
	3.5	3.5	45.0	44.5	772	681	1.50	1.50
	3.0	3.0	47.0	43.0	681	545	1.25	1.50
	3.5	3.5	48.0	48.5	817	863	1.50	1.75
	4.0	3.0	51.0	49.0	999	863	1.50	1.50
	3.0	2.0	49.0	48.0	817	499	1.00	1.00
	3.0	3.0	46.0	43.0	681	545	1.00	1.00
	4.0	3.0	49.0	45.5	863	636	1.50	1.25
	3.0	3.0	49.0	45.0	772	636	1.00	1.00
	3.0	3.0	46.5	51.0	726	772	1.25	1.00
	3.0	3.0	46.0	49.0	726	772	1.50	1.25
	3.0	3.0	47.0	42.0	681	636	1.50	1.00
	4.0	3.0	47.5	41.0	863	499	1.50	1.00
	3.0	3.0	46.5	49.0	681	772	1.25	1.25
	3.0	3.0	49.0	48.5	863	772	1.25	1.25

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AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)

Paragon Seed, Inc.

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

Exp. 8512

3. VARIETY NAME

Grand Slam

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*

507 Abbott Street
Salinas, California
93901

5. TELEPHONE *(include area code)*

831-753-2100

6. FAX *(include area code)*

831-753-1470

7. PVPO NUMBER

20030215

8. Does the applicant own all rights to the variety? *Mark an "X" in appropriate block.* If no, please explain. [X] YES [ ] NO

9. Is the applicant (individual or company) a U.S. national or U.S. based company? [X] YES [ ] NO
If no, give name of country

10. Is the applicant the original owner? [X] YES [ ] NO *If no, please answer one of the following:*

a. If original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. national(s)?

[ ] YES [ ] NO If no, give name of country

b. If original rights to variety were owned by a company(ies), is(are) the original owner(s) a U.S. based company?

[ ] YES [ ] NO If no, give name of country

11. Additional explanation on ownership *(if needed, use reverse for extra space)*:

PLEASE NOTE:

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definition.